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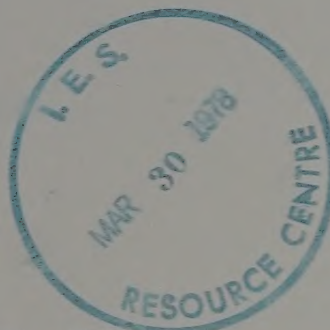
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THE USE OF PESTICIDES AND HERBICIDES IN ALBERTA



REPORT AND RECOMMENDATIONS

FEBRUARY, 1976

Alberta

ENVIRONMENT CONSERVATION AUTHORITY





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**THE USE OF PESTICIDES
AND HERBICIDES
IN ALBERTA**

**REPORT AND
RECOMMENDATIONS**

FEBRUARY, 1976



**ENVIRONMENT CONSERVATION AUTHORITY
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LETTER OF TRANSMITTAL

March 5, 1976

Lieutenant Governor in Council,
Legislative Building,
EDMONTON, Alberta.

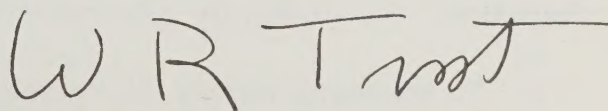
Honourable D.J. Russell,
Minister,
Department of the Environment,
222 Legislative Building,
EDMONTON, Alberta.

Dear Sirs:

I have the honour to transmit herewith the Report and Recommendations of the Environment Conservation Authority on The Use of Pesticides and Herbicides in Alberta, as required by Section 7 (1) (e) of The Environment Conservation Act (Ch. 125, R.S.A. 1970 with amendments to June 6, 1974).

I have the honour to be, Sirs,

Your obedient servant,

A handwritten signature in dark ink, appearing to read 'W R Trost'. The signature is fluid and cursive, with a long horizontal stroke extending from the end.

W.R. TROST
Chairman,
Environment Conservation Authority

ACKNOWLEDGEMENTS

The contribution that a Public Hearing can make to the advancement of any subject depends very largely on the submissions, briefs and presentations made to it by members of the public. The Environment Conservation Authority is very appreciative of the considerable effort of individuals, groups and associations in preparing their submissions to the hearings, and indeed in acting to bring about the hearings themselves.

It is also most helpful and desirable if those who prepare submissions can have ready access to relevant information dealing with the subject under enquiry.

In preparation for its public hearings on the Use of Pesticides and Herbicides in Alberta, the Authority found that it was first of all necessary to collect a great deal of highly complex scientific information on the subject. This was done through a series of technical sessions organized and conducted by the Authority's Science Advisory Committee, who were also responsible for the condensation of this information and for enabling its presentation by the Authority to the public as a set of five information bulletins. Information on the current use and value of the pesticides and herbicides in Alberta was also part of the subject and the Authority is most grateful for the cooperation of the Alberta Interdepartmental Committee on Pesticides in the preparation of Information Bulletin No. 8 entitled, *The Effects of Pesticide Use on Productivity and Health in Alberta*. All these bulletins were very widely read and served to provide the basis for a great deal of discussion during the hearings.

To the members of these committees and the many other scientists from the universities, the departments of government, industry and the general public who so generously gave of their special knowledge and their time, the Authority expresses its gratitude.

To the many others who acted throughout the hearings as resource personnel and those who came forward to relate unique or unusual experiences, or to volunteer new or altered approaches to the problems surrounding the use of pesticidal substances, the Authority also owes a special debt of gratitude.

Finally, to the very large numbers who attended the hearings, to those who participated and particularly to those who expressed and defended views and opinions that appeared to run counter to the general trend, the Authority records its appreciation and its admiration.

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ABBREVIATIONS AND TERMS

BIOCIDE:	Any chemical substance formulated to destroy or to suppress living organisms.
CARCINOGEN:	Any substance which tends to produce cancer in the animal body.
CULTURAL CONTROL:	Efficient farm practices which reduce the need for herbicides and pesticides.
Fungicide:	A chemical formulation used to kill, or control, disease-producing fungi.
Herbicide:	A chemical formulation used to kill, or control, weeds.
Insecticide:	A chemical formulation used to kill, or control, insects.
Larvicide:	A chemical formulation used to kill, or control, insects in the larval stage.
Mutagen:	Any substance that causes one or more heritable characteristics to change, by causing a change in a gene or chromosome.
Non-target species:	Those plants, insects, or animals that in the specific situation are not considered as pests and therefore should, if possible, be protected from the pesticide.
Pest:	A noxious, destructive or troublesome thing. It includes such things as weeds, plant and animal diseases, some species of insects, mites, predator animals and rodents.
Pesticide:	Any substance or mixture of substances, sold or represented for use in preventing, destroying, repelling or mitigating any insect, nematode, rodent, predatory animal, bacteria, fungus weed or other form of plant or animal life or virus, except a virus, bacteria or fungus in living man or animals.

Residue:	A deposit that remains in, or on, a plant or animal following the application of a pesticide.
Rodenticide:	A chemical formulation used to kill, or control, rodents such as rats.
Systemic pesticide:	A pesticide which is absorbed by and flows through the plant or animal to which it is applied. As a result, the plant or animal becomes toxic to the target pest.
Toxicity:	The degree to which a substance is injurious to a plant or animal.
Weed:	A plant that grows where man does not want it to grow.
LD₅₀ :	Median lethal dose in amount of toxicant lethal to 50 percent of the animals to which it is administered under the conditions of the experiments.
mg/kg:	milligrams per kilogram.

1. INTRODUCTION



1. INTRODUCTION

The Authority's enquiry into The Use of Pesticides and Herbicides in Alberta began in 1971. Shortly following its formation, the Authority received its first instructions from the Premier in a letter which said, "A secondary concern, for which the government requests the services of your Authority, relates to the expanding federal and provincial policies and programs involving the use of chemical compounds, such as pesticides, herbicides, etc., which present a threat of serious long-term environmental consequences." In the same letter, the Authority had been asked to place its primary emphasis upon "all present legislation and industry practices relative to the conservation and reclamation of land that is disturbed as a result of oil, gas, coal and forestry developments." Subsequently, when the Department of the Environment was established and a Minister named, the Authority was asked to give a higher priority to other hearings. The importance of the enquiry into The Use of Pesticides and Herbicides in Alberta was still recognized and work on it continued.

In its preliminary investigations, the Authority soon came to the view that a public enquiry into the use of pesticides and herbicides would involve technical and scientific inputs of considerable complexity. It was evident that this input, written up in a readable way, should be made available to the public prior to the hearings, if the arguments and discussions contained in the submissions were to have full weight.

The Authority therefore decided to develop what it called "the two-stomach approach." It would first of all seek the cooperation of its Science Advisory Committee to hold technical sessions in which the scientific and technical aspects of the subject were explored in detail and out of which information bulletins would be written for public distribution. The next step would be the presentation of this predigested material in non-technical language to the public in ways that would give them ample opportunity to study it, to consider their own experiences and needs in respect of the uses of these chemical materials and then report upon their findings to the hearings.

1.1 THE PASSAGE OF TIME

All of these steps took time. The Authority's Science Advisory Committee agreed to sponsor the technical conferences. An Ad Hoc Committee was set up under the chairmanship of Dr. David Boag. Scientists were invited from universities, industry and government in Alberta and throughout

Canada. A three-day technical conference was held after considerable preparation that in turn led to the production of five information bulletins dealing with introduction and registration procedures, the use of fungicides in Alberta, the use of herbicides in Alberta, the use of insecticides in Alberta and the use of vertebrate poisons in Alberta.

It was also at this time that a fundamental difference in view appeared within the scientific community. The Authority had known of this from the outset and believes it understands why this difference in view, which continued throughout the hearings, was both justifiable and necessary and indeed helpful to the process of the public hearing.

1.2 THE DIFFERENCES IN VIEW

1.2.1 The Green Revolution

In recent decades agricultural practices have undergone sweeping changes. These transformations, sometimes called the Green Revolution, have come about through the dedicated work of many scientists in many disciplines who devoted their thought and their lives to the alleviation of the problem of food shortages in the world. Among the important contributions these scientists made was the synthesis of many new chemicals that could control weeds, harmful insects and other living species considered to be pests by man.

Another important development was the use of growth stimulants including fertilizers which could increase the rate of growth both of plants and animals. Put together, these approaches with their strong emphasis on the use of synthetic chemicals including many compounds not before known, led to a marked increase in agricultural productivity. At the same time many new highly productive hybrids and plant species were developed that depended more strongly than the old species upon the steady and relatively heavy application of the new chemicals. Otherwise, without fertilizer or without chemical protection from living forms to which the new species were susceptible, the high yielding hybrids did not do well.

To invent better ways to grow food is one thing. To have it applied in the field is another. Consequently the scientists had, in many cases, also to become advocates and educators, and to lead the

farming community into the use of the new chemicals so that food problems in the world as a whole could, in their opinion, be ameliorated and diminished. This further deepened the commitment of many scientists to the Green Revolution that they had nurtured and, in so many important ways, helped to bring about.

1.2.2 Hazards and Side Effects

At the same time, other scientists were beginning to detect significant secondary effects some of the chemicals were having on other forms of life. Man had been aware of this possibility from the beginning. Chemicals synthesized to control a pest, were, of course, having an effect on a living species. Different forms of life have much in common. Most simply, all forms of life are made up from a group of interactive and inter-related molecules. These organic chemicals are all made for the most part from only four elements, namely, carbon, hydrogen, oxygen and nitrogen. Because of the chemical similarities and inter-relationships between these complex and sensitive organic chemicals, it was suspected from the outset that chemicals that affect one form of life might also have some kind of effect on other forms of life. This position was thought to be all the more likely since the new synthetic chemicals, the pesticides, herbicides and biocides in general, were also members of the family of chemicals that chemists call organic. That is, they were chemically similar to the molecules in living individuals but were not for the most part precisely identical with any known naturally occurring molecular substance. The possibility for interaction was therefore immense but the possible results of the interactions were in the beginning quite unknown.

Harmful effects can also arise from the use of inorganic or hard chemicals such as metals like mercury and arsenic. Some of these when incorporated into organic chemical compounds are also widely used and present risks that are also becoming more familiar. The rule of thumb, however, is that unnatural chemical interventions are statistically more apt to be damaging than helpful, to living species. In any event it has always been suspected that a chemical able to affect one form of life might well have some kind of effect on other forms of life.

It soon became apparent that these apprehensions had some basis in fact. DDT, thalidomide, even the drug-addictive chemicals that began to make their appearance, gave clear evidence that even in minute amounts they could produce surprisingly significant and harmful results in quite

large living individuals. These effects might be on the health of the individual, or on the embryo developing in the mother's womb, or they could affect the genetic structure and thus be transmitted from generation to generation.

These are, of course, serious concerns and some scientists began to work seriously at these problems. Their dedication to a matter that in their view had genuine significance for the health of mankind and other living species also led them to personal and professional commitments. Their dedicated efforts in turn expanded the field of knowledge and gave substance to the nature of the damage the new chemicals could produce in off-target species, or as secondary effects arising from their impacts on target species. These researchers showed that the Green Revolution had a second, less beneficent face. It would follow then that attention had to be paid to both faces if a balanced and rational view was to be obtained.

By this time it was no longer uncommon for scientists to strongly disagree with each other as to the net benefit that the uses of particular chemicals might have on life forms. It was at this stage in the evolution of the social view as to the benefits and disbenefits of pesticides, herbicides and related chemicals, that the Premier asked the Authority to enquire into the subject.

1.3 THE TECHNICAL CONFERENCE

The Technical Conference was held and the information bulletins emanating from it were published under the title "The Use of Biocides in Alberta." It soon became apparent that even the name given to these chemicals was to be controversial. The scientist whose principle objective and aim was the maintenance or expansion of the Green Revolution preferred to call the chemicals pesticides, herbicides, fungicides, etc., naming them so that they seemed to kill only those kinds of life that did damage to crops and other food products and were therefore beneficial to man. The scientists who were concerned about the secondary effects of the chemicals preferred to use the word biocide, since it signified that these chemicals might also affect other forms of life and in principle could have harmful effects on any form of life including man. The implications would be that biocides should be used with great caution, if at all, while pesticides should be used aggressively, with vigour and with a sense of purpose. The arguments arise when the same chemicals are given both terms, though by different people.

1.4 EVERY QUESTION HAS SEVERAL SIDES

The Authority is always concerned with having reliable and informative data that can be presented with confidence to the public. The Technical Conference provided five information bulletins and the Authority had three additional information bulletins prepared to cover different aspects of the subject on which representation was still needed. Among the latter, an important information bulletin was prepared through the cooperation of the Alberta Interdepartmental Committee on Pesticides by McAllister Environmental Services Ltd. entitled "The Effects of Pesticide Use on Productivity and Health in Alberta." The objective in this publication was to bring out the positive and proven beneficial aspects of the use of chemicals in Alberta, both in respect of increased productivity and in the improvement to health both of man and of other living species.

The Authority was itself very pleased with the eight information bulletins that were produced by the scientists who worked hard and gave of their time freely in the public benefit. It is, however, necessary to say that, at any rate initially, all of the scientists who had made contributions to these publications were not yet in full agreement with each other. The titles of the eight information bulletins are listed in Appendix II and are available on request to the Authority.

1.5 PRESENTATION TO THE PUBLIC

The Authority had the good fortune to win the cooperation of Unifarm in its distribution of the information bulletins to the farming community and in its pre-hearing preparations in a general way. The eight information bulletins had been given a wide public distribution and were made available in the 53 Information Centres the Authority maintains in the public libraries, community colleges, universities and other offices throughout the province. Under the auspices of Unifarm, public information meetings were held by the Authority at 14 centres throughout the province, at which general discussions occurred about the use of pesticides and herbicides in Alberta, about the information bulletins and about ways in which individuals or groups could proceed in preparing their submissions for presentation to the hearings which were to follow later.

1.6 THE PUBLIC RESPONSE

The public hearings were held in two series. The Authority first of all held hearings throughout the province in 14 centres, after the fall work had been done on the farms. The principal objective in these hearings was to get as much advice and information as it could from the people in the province who actually use these materials. Subsequently, after the New Year, a series of hearings was held in Edmonton when technical submissions were received. Throughout these very extensive hearings a strong undercurrent of controversy and disagreement could be felt and this was to be understood since the interests and livelihoods of people were directly involved. There were important conflicts and a suspicion that these could not be resolved unless victory went to one side and defeat to the other. It was only later that it began to appear that this need not be the case.

1.7 THE RESOLUTION OF CONFLICTS

Initially the controversy had existed among the scientists. Then it seemed to centre on the information bulletins. Later it moved into differences of view among members of the public at large. It was about at this stage that the trend towards resolution of conflicts began to appear. The hearings began to depolarize themselves as people began to recognize that the problem could perhaps be defined and could be handled in appropriate sensible ways. The discussion moved away from strong and even emotional attacks on what might be called "the other side" towards suggestions as to what should sensibly or could sensibly be done.

In the end, after the public hearings were over, the Authority again convened a meeting of scientists who had espoused the several points of view. The discussion concentrated upon those differences that still remained and sought factual and scientific resolutions of any outstanding problems that could still be approached in that way. The meeting was most helpful and what was even more pleasing was the extent of agreement that prevailed.

The Authority is most appreciative of the excellent cooperation and help it did receive in this complex and controversial enquiry from the citizens of the province, from the scientists in the universities,

in government and in industry. It above all appreciates the strong and intelligent way the diverse points of view were presented, the candor of the exchanges, and finally the good sense that was shown as mutually acceptable solutions began to appear.

1.8 THE SITUATION IN OTHER PROVINCES

In the several years the Authority has had this enquiry under way, similar enquiries have been established in other provinces in Canada and pertinent legislation has been modified or is being proposed for modification in Alberta, in the other provinces and in the federal statutes. The Authority has had communication with the British Columbia Royal Commission of Inquiry on Pesticides and Herbicides, and with the Commissions of Inquiry in Manitoba and Ontario, and has kept itself informed as to statutory changes under consideration by the federal government.

2. RECOMMENDATIONS

2.1 BASIC CONCEPTS and CONFLICTS



2. RECOMMENDATIONS

The task assigned the Authority by the Government of Alberta was through public hearings to enquire into the expanding federal and provincial policies and programs involving the use of chemical compounds such as pesticides, herbicides, etc., which present a threat of serious long-term environmental consequences. The benefits of use were to be weighed against the hazards that might develop from continued and widespread application of these chemical compounds so that future social and economic development would be in harmony with the goals of environment conservation. From the views presented on these and related topics the Authority was to report and make recommendations on the use of pesticides and herbicides to the Government of Alberta.

The Proceedings of the Hearings are published separately. In the following pages the Authority presents both general and specific recommendations since it is concerned with some of the wider implications of the task assigned to it as well as with numerous more detailed aspects. In the discussions preceeding the recommendations the Authority has assembled and displayed the arguments that led to its recommendations.

2.1 BASIC CONCEPTS AND CONFLICTS

The intense interest in the hearings generated from the fact that two basic concepts, each fundamental to the health of the human species, were being discussed in relationship to each other, often under the assumption that they were mutually irreconcilable. The deep concern that man remain able to feed the increasing human population was a constant background to the hearings and must remain as a strand running through all of the discussions and recommendations that emanate from it. This many-faceted problem certainly has some strong direct connections to the use of chemicals to enhance productivity and to control the growth of living species either harmful or not useful to man.

The second theme that constantly coloured and gave form to the discussions was a concern about the balance of living species, particularly whether man's knowledge and practices enabled him to maintain that balance between human species, domesticated species and species not yet domesticated by man that was necessary for the continued existence of life on earth including, above all, human life. The pragmatic basis for

the use of pesticides, herbicides and related chemicals is the fact that they can control the populations and in restricted regions at least, perhaps even the existence of certain species. The further question as to whether or not they also affect populations of non-target species in unexpected ways and hence create unknown imbalances among the populations of the species becomes a possible consequence. Again, the effect on human life is of paramount importance. It may be manifested directly on human beings, or indirectly through effects on populations of non-human living species that in turn affect mankind. It is important, and indeed part of the instruction to the Authority, that the theme of the balance of the species be included within the recommendations that emanate from the hearings.

2.1.1 Productivity and Populations

It was generally assumed throughout the hearings that human populations in the world as a whole would continue to increase, and at rates sufficiently high to challenge the capacity of the world to produce the food to feed its people. Problems are in no way uniform in this regard, with different nations and different regions having their own complex of present and future prospects and perplexities. For its own part, Alberta has a relatively low population density, a relatively large food-producing capacity somewhat tempered by a short growing season and long, cold winters.

The prairie provinces, of course, traditionally think of themselves as a food exporting region. The climate and statistics also indicate that they import foods, and indeed food products that could be grown in the provinces. The imports are substantial and partly counter balance the role of the province as a net producer of food for world markets. In the overall there seemed an acceptance which the Authority shares, that the province has a responsibility to reach and maintain productivity levels that reflect the best interests of world populations, as well as the best interests of the province itself. There are conflicts and brief reference will be made to some of them.

2.1.1.1 Pesticides and Productivity

Within the borders of the province great changes to the general environment have brought about sometimes startling increases in production of crops and livestock for food, fibres and a wide variety of other products. Long strides have been taken along a path which commits the province to produce these materials at ever higher levels, not only for internal consumption, but for a world whose population is said to be increasing now at the rate of 70,000,000 annually. As a result the decision about the level of food

productivity is becoming less and less dependent on the province's own needs. On this basis food producers are urged, for moral considerations, to respond positively to a world demand for increased supplies.

As the intensity of agricultural practices increases and as monocultural methods become ever more widespread, control of the many biological forces which reduce productivity becomes increasingly necessary. Similarly, as the demands upon food productivity grow, the need for pest control also grows. Like an inflationary spiral, mankind is generating a need for controls at an ever increasing pace. The control of crop damaging pests can be accomplished in two ways, chemical and non-chemical. Perhaps the ideal is a fully integrated control system employing all available methods to best advantage. However, the choices which are made by individual producers have their basis in such factors as cost and benefit, ease of use, speed of attainment of results and applicability of each method to a given agricultural area or type of farm operation.

Crop rotation and good tillage practices have proven effective against weed infestations and are especially applicable to the mixed farming operation, but there are limitations to these methods. The farmer who produces grain alone is unable to utilize full crop rotation while tillage practices, which take land out of production for a period of time, can represent a financial loss. It has been commonly concluded that chemical control of the wild oat is cheaper than control through tillage and summerfallow. This is partly because chemical control allows continuous cropping while land in fallow is not productive. In the case of insect pests, an outbreak of grasshoppers or a sudden infestation of Bertha armyworms will not respond to non-chemical controls effectively. An important influence on the farmer's decision to use a particular method of control is the fact that he has been under increasingly heavy financial pressures which he attempts to relieve by increasing productivity.

There are differences of opinion concerning the effectiveness of pesticides in increasing agricultural productivity. There is, however, a strong general feeling within the agricultural community that pesticides must be used if production levels are to be maintained or increased. Wild oat control is widely accepted as a necessity. Control of rusts and smuts, aphids, flea beetles, Bertha armyworms, grasshoppers, Warble flies, cattle grubs and lice, clover and alfalfa weevils, root maggots, cutworms and potato beetles seems necessary if maximum productivity is to be achieved.

Though the role of pesticides in increasing agricultural productivity seems well demonstrated in some cases, many questions still remain. How general need the use of pesticides be? Are farm management methods that eschew the use of chemicals in part or altogether once more proving out? Will high pressures of costs and of supply shortages compel thriftier use of chemicals, even in those cases where their use is thought to improve productivity? Has anything like sufficient attention been given to the undesirable effects attributed to pesticides use, including off-target and secondary effects? Do pesticides and their residues sometimes build up, creating productivity and habitat problems in the long-term that may not appear now? These and other questions provide an important background to the discussion and recommendations.

2.1.1.2 Problems in Improving Productivity

The most direct conflicts arise when chemicals that might enhance the productivity of one crop impair the yield of another. Honey is an important and high-quality product of apiaries both in southern and northern Alberta. Bees can be killed by insecticides and perhaps damaged by some herbicides so that honey production can be hurt by the applications of chemicals that might improve the yields of cereal, seed and forage crops and may even be critically needed to protect such crops from serious encroachments by agricultural pests. There are many examples of these kinds of conundrums in which what is sauce for the goose is definitely not sauce for the gander.

For those who grew up in rural communities before the war the use of chemicals on farms, whether as fertilizers or pesticides, was an innovation. Indeed the use of these synthetic materials met strong resistance in many cases, often from the better farmers, before final acceptance came. Now these innovations have been so fully integrated into agricultural practices that their use represents established practice and are often referred to as the conventional method of farming. There are two points of interest to be made.

First of all not all good farmers in Alberta took up or retained the use of synthetic chemicals. Some instead retained and indeed improved upon the best farm management practices of the past. Representations were made by such farmers, and by their neighbours, that well managed farms not using chemicals remained as productive and were as free of weeds and other pests as the neighbouring farms adjoining them. These were mostly mixed farms.

A second interesting point also arose. There is a new movement among young agriculturists to limit or eliminate the use of synthetic chemicals, again including fertilizers as well as chemicals. This movement is, of course, not restricted to Alberta. This is sometimes called organic farming and was begun partly out of a fear or a knowledge of the short and long-term ill effects synthetic chemicals had on the natural processes on land, air, water and the living processes. It was almost accidentally discovered, so it has been reported, that productivity could be maintained by organic* or natural farming if suitable management practices were followed. The Authority acknowledges the representations made to it on this subject by an Alberta farmer who had used a Nuffield Fellowship to study the same problems in England to corroborate and support his own and his neighbours' experiences in Alberta.

The significance of these tests and trials by a few has been immensely heightened by recent events, particularly the sharp increase in the cost of synthetic chemicals and the emerging possibility of chemical supply shortages in the future. Rising costs have seriously cut into farmers' incomes and brought into sharper focus the need to evaluate alternatives that can reduce or eliminate these cost burdens still retaining net overall benefits. It would seem reasonable to suggest that comparative studies should be done by well-qualified researchers to determine whether, and if so under what conditions, advantage can be gained by limiting or eliminating the use of synthetic chemicals in full-scale commercial farming operations in Alberta. In such a study natural organic farms would be compared with conventional farms, all to be of commercial size and in initial studies, all to be farms that raise livestock as well as forage and cereal crops, that is, mixed farms.

There is a need, however, to begin new studies in Canada on the general question of chemical and energy inputs to agriculture to determine what is or will be most desirable both from an economic as well as from a human health and environmental point of view. It is suggested that scientists and farmers might be well advised to take a new look at the comparative advantages of high chemical, high energy farming as against low chemical, lower energy farming.

* Natural organic farms are considered to be those which do not use synthetic chemicals. The word "organic" is beginning to gain popularity for this usage.

Representations supporting this suggestion were made to hearings at central and northern Alberta locations and relate more to mixed farming than to large scale mono-culture types of farms. There were comments that the productivity of such farms would not be as efficient as the modern farm using chemicals. However the individual success of the farmers making the submissions was supported by other farmers.

2.1.1.3 Productivity and the Environment

The Green Revolution has put at least three things together. These are the systematic use of fertilizer to increase plant growth, the use of pesticides and herbicides to eliminate undesired species and thereby increase yields, and the use of new and more productive plant species whose survival depends upon the controlled environments provided by the fertilizers and the biocides. In attempting to plan a suitable course of action for increased productivity several questions arise. First of all to what extent can productivity be increased in Alberta by improved practices in the above three areas? Secondly, can the techniques of the Green Revolution enable additional lands to be brought into useful production in Alberta? Finally, do any ill effects accumulate with the passage of time that will limit the productivity of lands that have been exposed to the continuous application of these agricultural techniques?

Though in food production every reason stands on its own, there seemed a consensus among experts and laymen alike that some improvement in productivity, and possibly some extension in productive acreage, was still possible in the province but the estimates, particularly from professional sources, were generally for quite small percentage increases. There was also a concern that the quality of the land could be affected unless remedial measures were taken. Evidence was submitted to show that the nitrogen content in soils was not maintained by the addition of chemical fertilizers containing nitrogen alone. Salinity seepages to lower levels, as well as solute runoffs to ground and surface water systems, were associated with the continued application of fertilizers in dry land as well as in wet land farming.

The buildup of residues from pesticides and herbicides posed problems that were not well defined but included difficulties in certain crop rotations and, of course, depended directly on the specific chemical that had been used. In short there was evidence that the intensive and systematic use of chemical compounds, including pesticides, herbicides, fertilizers etc., could present a threat of serious long-term environmental consequences to the land itself.

This factor then had to be used to balance the responsibility a region had to enhance its production of food by artificial methods so that it could provide sustenance to people who needed food in other parts of the world.

2.1.1.4 Self-Help or Food Supplies Aid

A difficult moral and ethical question arises when populations and food supplies are considered and these were discussed during the hearings. When populations in regions have the great misfortune to outrun their food supply so seriously as to expose multitudes to famine and hunger, a spontaneous and human response is to supply food to those people on an emergency basis. In such cases the hardship suffered by the region may well be so severe that payment is neither possible nor expected. In a more general extension of a problem that is indeed present in the world, populations in some regions may be chronically undernourished and underfed while peoples in other regions may have surpluses.

The problems might easily be dismissed by suggesting the food be shipped from the region that has it to the region that needs it. Or people could be moved. One factor in the problem is that the food may well have to be a gift. Another factor in the problem is that population densities may be maintained in regions that exceed the self-support levels. A basic position for any country to adopt may well be that it should not help others beyond the point where its ability to help in the future will be impaired.

A further question is whether or not assistance can best be offered through ways that solve the problem only for the day or whether more permanent solutions should be sought. If improved agricultural practices are possible in regions short of food it would seem sensible to choose that path. However the nature of the crises will carry its own imperatives.

Emergency situations like the classical famines, floods, pestilences, and wars will still need emergency attention. However in a general way there would seem to be merit in the maxim that it is better to help people help themselves than just to help people.

There will be many specific recommendations relevant to these aspects in later sections of this report. Some general recommendations, however, are appropriate now to provide a background against which discussions and recommendations on more specific aspects of pesticide and herbicides use in Alberta can be developed.

RECOMMENDATIONS

- (1) That the province accept its responsibility to reach and maintain productivity levels that reflect the best interests of world populations as well as the best interests of the province itself.
- (2) That all evaluations of the use of pesticides and herbicides in Alberta take into account their effect both on the availability of food for the human population and on the balance of species that needs to be maintained for man's purposes.
- (3) That the improvement of agricultural productivities and practices in countries where food supplies are deficient be supported and in some cases, in place of gifts of food, to solve short-term problems in those countries.
- (4) That a country, and regions within a country, accept as a natural limit to its food productivity that point beyond which it cannot go without impairing its long-term productivity.
- (5) That increased food productivity in the present and short-term not be sought at the cost of decreased food productivity in the longer term.
- (6) That it be recognized that pesticides must be used in some cases and can be used to advantage in many other cases but that their overuse or their misuse is both wasteful and risky.

- (7) That procedures be worked out, improved and adopted to avoid damaging one crop while protecting another.
- (8) That soil monitoring be done more extensively within the province to determine whether and to what extent, the techniques of the Green Revolution are changing the quality and nature of productive soils in the different regions of the province.
- (9) That it be recognized that the increasing reliance on the three components of the Green Revolution namely:
 - a. the systematic use of fertilizer to increase plant growth
 - b. the use of pesticides and herbicides to eliminate undesired species and thereby increase yields
 - c. the use of new and more productive species whose survival depends upon the controlled environments provided by the fertilizers and the biocides,increases the magnitude of disasters mankind can be exposed to if any one or more of the three components comprising the Green Revolution fails or must be abandoned.
- (10) That when an extension of the area of cultivated land is made possible by the techniques of the Green Revolution, the decision to proceed include a consideration of the integrated land use and water management principles for the region as well as the longer term consequences for the newly cultivated acreage itself.
- (11) That farmers and educational programs for farmers give greater emphasis to fully integrated farming systems employing all available methods to best advantage including mechanical, chemical, waste recycling and other farming practices to attain the objectives of the best sustainable agricultural productivity.
- (12) That comparative studies be initiated, on a systematic long-term basis, of natural organic farming and farming based on the use of synthetic chemicals including both pesticides and fertilizers.
- (13) That these studies be done on commercial scale farms and that attention be paid to the net gain to the farmer, to the productivity of the land, to the nutrient value of the produce, and to the health and environmental aspects, including the continued viability of the soil, both for mixed farming and for mono-cultural producers.

- (14) That these studies be supported through grants from agencies at the federal and provincial levels and the results of the studies be freely communicated.
- (15) That these studies be undertaken by scientists and farmers under the auspices of a Centre for the Study of Agricultural Systems to be established within universities and colleges in Alberta and Canada.

2.2 THE BALANCE of the SPECIES



2.2 THE BALANCE OF THE SPECIES

Man depends directly for his own survival on species that he in no way controls as well as on species that he has found it possible to domesticate and use for his own purposes. Man's inventiveness and ingenuity has enabled him to control life forms to provide many of his own requirements, particularly in respect of food, shelter and even such items of luxury as cultured pearls. Man is, however, still far from that control of his environment in which he could survive without undomesticated species even if the wildlife he enjoys to hunt are included among the domesticated sort. The dependence of man on other species is most clearly shown in his relationship to oxygen. The air man breathes contains this indispensable element for the maintenance of human life. It is provided, however, not by man himself nor any of the animal species, but is instead, as is known to every school child, a by-product of the growth of plant life.

In a way plants and animals represent opposite ends of a balance that Nature maintains. Plants use carbon dioxide and water and with the aid of sunlight store up carbohydrates and release oxygen to the air. The carbohydrates and the other chemical materials in the tissues of dead plants can be further deoxygenated as the plants are reduced to humus, peats, coals, oils and natural gas. In this process, too, additional oxygen is liberated. Man, on the other hand, uses oxygen to consume foods and fossil fuel transforming them back again into the water and carbon dioxide which are source materials for plant life. In so doing man makes available to himself the energy that had been absorbed when the plants were made.

There may well have been times when plant species dominated and that the fossil fuel reserves now being consumed represent botanical graveyards that accumulated from a time on earth when plant species were overwhelmingly the major form of life. Indeed some think that in those primordial times, an atmosphere initially deficient in oxygen became enriched in this element because of the abundant plant life. By contrast there are now thought to be indications that with the dominance of man, animals may be consuming oxygen more rapidly than the plants are producing it, once again changing the concentration of gases like carbon dioxide in the atmosphere. In sum, there is a need from man's own point of view to maintain a balance of species so that the biosphere will retain those elements it needs to support human life as well as the lives of other species. There are also other reasons why a balance of species needs to be maintained.

2.2.1 Biocides and the Balance of Species

Man has been wonderously creative, particularly in the twentieth century, in synthesizing new chemicals able to affect the course of life. One remarkable factor is the immense disproportion in mass between the synthetic chemical and the life form it affects. Surprisingly small amounts of the chemical can produce considerable effects in surprisingly large individuals, or large groups of small individuals. Any one chemical may produce quite different effects in individuals from different species and may also have more than one kind of effect on a single individual. It is when they are used as biocides that their primary and secondary effects on life forms become a part of the term of reference of these recommendations.

The deliberate and systematic synthesis and use of chemicals potent to control, diminish, kill or alter the form of living species clearly has direct effects on the population of particular species and consequently upon the balance of the species and how that might change from time to time. Because of the numerous interdependencies between different species, whether it be symbiotic, parasitic or predatory, a change in the population of one species may have direct, indirect, or even delayed effects upon the populations of others. There have often been inadequate ways of determining ahead of time what these secondary effects might be and even direct effects on off-target species have gone unknown.

There is an indication that what are sometimes surprisingly potent chemicals may have other combinations of effects. The chemicals might bind with other chemicals in the soil or in plant life or in animal tissues and produce untoward results. Some of the chemicals that have been used to kill or control particular living species have been shown to have carcinogenic, teratogenic or mutagenic effects on other species. There seems to be growing evidence that a chemical that can produce one of these abnormalities has a greater than average chance of also being able to produce the other two.

Carcinogens frighten the human species with the horrors and ravages of cancer. Such an effect, however, leads only to the deaths of individuals. Chemicals that cause changes in the genetic code produce effects that pass from generation to generation and these changes are for the most part deformities and disbenefits that may put a species to hazard, and indeed are used against pest species specifically because they do lead to long-term control. A further serious impairment is from

chemicals that cause defects in the embryo so that the newly-born individual may be seriously deformed or abnormal in ways that prevent that individual from leading a life normal to other members of the species. The degree of seriousness in these deformities, of course, varies from case to case and from chemical to chemical. It is, however, important to emphasize that life on earth is not always a peaceful affair and that the struggle for survival calls for unremitting attention to the needs of one's own species.

The effect of the pesticide chemicals may be extended by the cumulative effect of different chemicals used for different purposes in the same region. The chemicals can also be concentrated by passage through the food chain when a predator may retain a portion of a chemical in a particular organ or organs in amounts that increase with contact.

Man can be adversely affected in three ways. First, he may overkill a target species leading to species imbalances that are undesirable. Secondly, off-target or secondary effects on other than human life forms may lead to unexpected losses or environmental impairment. Finally, man's own health and the integrity of the human species may be put into some jeopardy.

2.2.2 The Battle for Survival

Natural environments in which synthetic pesticides are never introduced and in which only the natural biological processes occur are subjected to large variability in populations of living species. Many examples have been observed. Insect populations may grow explosively in numbers until some factors such as loss of food supply brings on a massive dieback. In other cases, insect populations through sudden increase may encourage the emergence of a predator which can eventually surpass the growth of the host population. In turn with the loss of food, the predator population may itself decline through starvation.

These simple examples indicate that Nature does not always maintain balances within limited guidelines but can react rather harshly to over-population. Nature's cure does not always appear to be a return to more reasonable numbers but can lead to a near-extinction of the offending population. Thus, in natural environments, especially those with relatively few species, extreme variations in individual populations are not uncommon. Some species appear to be more susceptible to such natural variation, perhaps because of the relative life spans or reproductive cycles in the species under consideration.

An interesting aspect of the natural state of affairs is that the biological processes which control populations tend to be selective. When Nature retaliates, her target is specific and it is those species which have seriously threatened the biological community that are most affected. Remarkably, when one species grows at the expense of another, the natural population controls are sequential so that often only one species at a time is affected. Further, Nature takes no action in anticipation of problems. However, when a specific population becomes large and is still increasing exponentially, a natural occurrence appears to be a sometimes sharp reduction in population either through starvation or through an increase in the population of predator species to consume it.

It is precisely this instability in Nature which has brought man into the process of biological interference through the use of pesticides. Man has often failed to appreciate the virtues of natural biological controls while being quick to point out its deficiencies. The need to control the population of various species is for the most part man-made, since in producing giant mono-cultures man encourages the growth in population of a single species by the exclusion of others. This act itself imposes an artificial stress on Nature and natural biological forces are often unleashed, sometimes dramatically and destructively, to remove the stress. Because man supports an artificial condition through mono-cultural practices, repetitive and regular interventions are needed to retain and protect these unnatural imbalances.

The principle applies to man himself. The use of pesticides becomes more necessary to human survival because man has already begun to press global food supplies through the extraordinary growth in human population. But that population growth was in large part brought about by the use of synthetic chemicals. Pesticides in use accomplish rapid population control of undesirable species which, from man's point of view, may be an improvement on Nature. On the other hand, pesticides are quite rarely specific to only the offending organisms and are, to that extent, inferior to natural biological controls.

It is always of the greatest importance to emphasize that the human species must look after itself and protect its own interests within a system of physical and biological processes that could otherwise have disastrous effects on mankind. This maxim, the Authority suggests, must be understood as a basic assumption in any discussion as to how man

might and should relate to other species. There are at least two issues, however, that have additional ramifications and might be ignored to the peril of the human species unless they are discussed. One of these derives from the potential for growth within the human species and the consequences this might have on the well-being of future generations. The other derives from the fact that most species, above all the human species, could not continue to survive as the only form of life on earth. At any rate it would not be possible under present or foreseeable circumstances.

2.2.3 Control of Pest Species

The word "pest" has been defined as anything that causes trouble, annoyance, discomfort, etc.; a nuisance; any destructive or troublesome insect, small animal, weed, etc; and the word "pesticide" has been defined as any chemical used for killing insects, weeds, etc. These definitions clearly connote that there has been a historical recognition of the fact that certain species create problems for man. The nature and intensity of the problems may vary widely and may have a large or small economic impact. In general species declared to be pests are so thought to be by a large majority of the human population.

Other species may or may not share this view with man, a question that is rarely either asked or answered. The main point, however, is that these positions are taken by man to protect his own species. There are somewhat different factors involved if the pest species is indigenous to the region or if it is a foreign species attempting to make a place for itself in regions that are new to it.

2.2.3.1 Indigenous Pests

Pests that are native to a region like mosquitos, black flies and coyotes in Alberta have generally established for themselves a role in the overall balance of life that is maintained in that region. That is to say, they either eat or are eaten by other species and thus create a chain of interdependence that extends throughout. Populations of particular species may fluctuate from year to year with subsequent effects on still other populations. The complete removal of any one native species may have consequences that are undesirable. The methods that may be necessary for control and for extermination may also have secondary undesirable effects on non-target species.

There is, in addition, what seems to be a growing feeling with moral and ethical content that it is undesirable for man to permit additional species to become extinct. There is at the same time the clear need in man's own interests to control populations of pest species. The benefit to man may be in improved health, comfort, greater productivity, or in other end results that are beneficial to human beings.

There may indeed be instances when it is necessary for man to gain complete protection against another species and though these instances seem to be rare they are often associated with disease carrying properties of the pest species and may be localized rather than global in nature. It is again clear that man must protect his own species and take what steps are appropriate towards that end. Prudence would indicate, however, that pest populations be handled in such ways as provide the requisite protection to the human species, but not to eliminate indigenous species nor give rise to unexpected and undesired secondary effects.

2.2.3.2 Pest Invasions

A rather different situation arises when pest species attempt to move into a region that they had not previously occupied. The most publicized example in Alberta is the Norway rat, a species not native to Alberta, and that has been kept out of Alberta by a vigorous rat control program begun in the early '40s. In cases like this the invading pest would have to make a place for itself among the indigenous species, upsetting life cycles and compelling adaptations to its presence if its invasion was successful.

To prevent a pest from taking up new territory need not in principle upset the balance of species that already exists in that region but would in principle rather maintain it. There is, of course, the question as to whether or not damage to non-target species occurs as a secondary result of the methods used to keep the invading pest at bay. In the particular case of the Norway rat both health and economic reasons have been advanced as positive motivations towards denying that species entrance into the province. The objective of the rat control program has therefore been to exterminate all Norway rats found in Alberta. The objective of the program seems to have general support and seems to have been achieved, both because the rat control program has been diligently applied and because citizens have cooperated fully with it. The question has been raised, as with the rabies control program, whether there has not been an overkill of off-target units.

A somewhat different example of pest invasion is provided by species like the Bertha armyworm, grasshoppers or other mobile species whose populations can expand abruptly under suitable conditions with disastrous consequences to sometimes quite specific agricultural crops. Changes in agricultural practice, particularly mono-cultural techniques, create new situations of which pest species can take advantage. In these cases it is much harder to keep the invading pest out of the region. Its initial appearance may be unnoticed or almost unnoticed while it slowly establishes its position among other species in the region. Upon finding a favourable combination of circumstances its population may suddenly explode in a period of a few years, sometimes even through one season, enabling it to threaten in extreme cases entire crops over substantial areas.

2.2.3.3 Off-Target Species

Part of the argument against the use of the word "biocides" as an umbrella term to describe insecticides, pesticides, vertebrate poisons, fungicides, etc., is the implication that these chemicals can kill all forms of life. The latter usage emphasizes the use of these chemicals against specific target species while the use of the word biocide emphasizes what is often called the non-target, or the off-target effect. The human species is always, in principle, an off-target species in these discussions, even though as outlined briefly elsewhere there are serious health hazards to man in the use of at least some of these chemicals. It is now appropriate to consider possible effects on non-target species other than man.

A chemical classified as a herbicide will have as its target species a specific plant or a group of plants. Chemicals can be designed to have either a wide spectrum effect within their category, or a narrow one. It may be quite narrow but is rarely if ever as yet restricted to a single species. Some precision has been achieved in the control of wild oats so that this weed can be controlled by herbicides when it is growing in wheat, rye and some other cereal crops. This makes it quite selective. However, herbicides that kill wild oats will also in general kill domesticated oats. Domesticated oats must therefore be considered a non-target species that is susceptible to a herbicide for which the target species is wild oats.

Other herbicides might have quite broad capabilities to curtail the growth of plant species. Some are so broad that they are called soil sterilants, although the manufacturers of Picloram which has a broad spectrum prefer not to use this description, not because Picloram is not able to eliminate the growth of all plants in areas where it is applied, but because it does not necessarily kill all forms of life in the soil including microbial forms. On the other hand the effect that herbicides and indeed insecticides might have on soil bacteria becomes an off-target effect of considerable significance because of the role that soil bacteria can play in soil quality and crop productivity.

The lack of specificity within a group can have wide ramifications. Among insecticides there is again a tendency for a chemical effective against one insect species to be also effective against many others. There may be advantages and disadvantages. DDT had a very comprehensive effectiveness against insects, as well as effects on non-target species that gave it a wide off-target capability. It was the off-target effects of this often useful chemical that led to the restrictions on its use including its abolition in some jurisdictions.

On-target and off-target effects may sometimes cause conflict of interest problems. A bee farmer and a cereal farmer may live happily side by side and even, depending on the nature of the crops, be of mutual benefit to each other. If the grain farmer must protect his crop from an insect invasion the insecticide he uses will not discriminate between the honeybees and the pest. So the bee farmer loses and the grain farmer gains. In such cases, procedures, practices and agreements need to be worked out, whenever possible, so that both interests are protected or losses, shared. In this particular case, improved practices to mutual benefit seem available.

An off-target effect may also be created in other ways. An individual or an organization may wish to spray a certain piece of land to gain a certain effect as in clearing brush on a right-of-way. In the course of pesticide treatment other lands may accidentally be sprayed, creating results that are to the disadvantage of the owner of the adjacent land such as the destruction of shrubs or crops in his gardens or fields.

A third non-target effect arises by the passage of chemicals from the target species or even from off-target species through the food chain or through the soil either in the form of the original chemical or

in metabolized residues of it, into still other species whose functions are then impaired. Again DDT and related chlorinated hydrocarbons are the classic examples of this kind of off-target effect but the problem continues to recur in the new synthetics, including those with short half lives in their primary form.

The presence of these residues in man's food may be quite significant as he can be the consumer of meat that contains the accumulated concentrations produced in the food chain process. Similarly residues in the soil will influence the contaminant level of vegetables used directly as human food or in whole or in part as fodder for livestock to be used in turn as food for people where these residues may have significant off-target effects.

The off-target effects can also be significant in the control of the unwanted pest by eliminating its natural predators either by direct toxic effects or by the destruction or adulteration of the predator's normal food supply. The imbalance created by elimination of the pest predators may in turn result in a subsequent revival of the pest. Similarly the predator itself may be a desirable species such as song birds and their decrease may be an unwelcome side effect.

2.2.4 The Growth of Human Populations

Man's history, so far as it has been able to be determined shows a very slowly increasing population, perhaps even subject to sharp fluctuations through some millions of years until relatively recent times when human populations have begun to increase exponentially. This is the form of increase that life forms exhibit when normal restraints on the species have been removed and successive generations come to maturity without check. The reasons for this flowering of human populations, some think, is the key that science and technology have provided to the resources of the world.

Man has also been ingenious enough to invent and develop increasingly secure environmental controls which reduce infant mortalities, protect against parasitic invasions, extend the life of individuals and improve the physical satisfactions and the health of individual people. Concern arises when populations outstrip or threaten to outstrip the resource base upon which that population feeds. The probability that this was happening to human societies had been suggested more than once during these centuries of rapid growth and the theory is most closely associated with the name of Malthus.

Fears of this sort are with society again today. Now many individuals and particularly the young are responding to these omens of disaster by actions that effectively reduce birth rates, decrease rates of population growth and at the same time lead to a new emphasis on what is desirable in the ideal life. It seems that the new ideal has shown a shift towards a reduction in resource consumption per capita rather than its increase.

The fears that the intelligent sensitivity of the human species expresses to itself is mirrored by their observation that other species who pass through propitious periods of time that enable rapid increases in population are followed by starvation, depopulation, death and disaster. The plagues of rabbits, locusts and lemmings and the recurrent cycles as populations build up rapidly, peak and then drop to sharply lower levels, are well illustrated in the histories of other species. There are many who would wish to avoid the exposure of the human species to a similar experience.

2.2.5 An Open-Ended Future for Man

The structure of the human species, as of all others, provides for continuance indefinitely into the future through successive generations. In all living forms, individuals whose spans are finite are gifted with the power to create new individuals that will carry on the full stigmata of the species, including its regenerative capabilities. This process is built into all species, whether man graces them with the power of thought or not. Trees, grass, gophers and grizzly bears all show, in their own way, the manner in which individuals are the mortal components of the immortal species.

The development within the human intelligence of thoughts and fancies that sought out the nature of the individual presence and exalted that individuality, might have directed some attention away from the fit of the individual into the continuity of the human species. Like all other individuals, however, the human being acts in part to maintain the presence of the species in his own time, and to perpetuate its continuance into the future. Though life is finite for him, he thus keeps the future open-ended for his species. Similarly written, consciously or not, individuals of all species act to fulfil their responsibility to keep that future open-ended for their own species and so to guarantee that those generations yet to come will not have life denied them.

RECOMMENDATIONS

- (1) That continuing and active recognition be given to the need to maintain that balance of species that will continue to generate the essential elements that make the biosphere viable to man and other living species.
- (2) That man assume responsibility, within his means and capability and by restraints of his own, to maintain continuing populations of all living species while protecting the continued healthy survival of the human species itself.
- (3) That the stress increasing human populations place upon the biosphere be identified as a fundamental factor in mounting biological imbalances including limitations appearing in the resource base for that population.
- (4) That the potency of synthetic chemicals to control populations, alter life forms and threaten life support systems be taken as a statement of fact, and programs for their use be undertaken only with a full knowledge of the risks involved and with adequate provision for their avoidance.
- (5) That in working towards the sound survival of the human species, society in its individual and corporate manifestations begin to be protective of a much longer future than heretofore has been the custom namely, centuries rather than decades and decades rather than years.
- (6) That in working to keep a future safe for the human species, man consider the pressure of his own present and foreseeable populations and the primary and secondary effects of his own contemporary activities on the populations, life support systems and viability of the generations that will occupy the future in the decades, generations and centuries ahead.
- (7) That when population control of some species is necessary, over-release of synthetic chemicals be avoided and other more natural control methods be given more emphasis.
- (8) That pesticides be used under such controls as will limit or eliminate off-target effects and secondary effects or long-term undesirable consequences on land, air, water or on living species.

- (9) That when the use of pesticides is necessary but still creates conflicts, procedures and understandings be worked out to resolve the conflict or share the loss.
- (10) That the need for man to protect himself from the inroads of pest species be recognized.
- (11) That normal pest control practice be to maintain the population of the species at a satisfactory level rather than to exterminate it completely.
- (12) That it still be recognized that instances may occur in quite exceptional circumstances, though perhaps just in specific areas, when man's livelihood is so threatened by a pest species that extermination may remain the only solution.
- (13) That when invasions of pest species, not indigenous to a region but posing health and economic problems to the region occur, control programs to keep the species from becoming indigenous are appropriate.
- (14) That the possibility that new or established domestic crops might become prey to introduced species that establish themselves and pose the threat of recurrent blights and plagues upon these crops, continue to be accepted as an undesirable contingency against which protective measures must be maintained.
- (15) That man's need to protect his own survival as a species be identified as a fundamental requirement and that limits imposed by the twin pressures of population growth and resource availability be incorporated into survival programs.
- (16) That, when a species seeks its survival, it be recognized that the objective is to keep the future open-ended for that species.

2.3 HUMAN HEALTH



2.3 HUMAN HEALTH

Pesticides, herbicides and related chemicals including fertilizers, generally fall into that classification of substances that man is well advised to handle with discretion. Specific chemicals will have specific hazards associated with their use but it is not unreasonable to consider them all as members of a class of chemical substances inimical to the physical comfort or under appropriate circumstances hazardous to the health of individuals. Some may be quite toxic, others attack specific organs, or cause respiratory problems, or inflammation of mucous membranes including the eye. If taken internally, nausea or more serious violent reactions might occur. If applied externally, absorption through the skin might produce lesions and upon absorption in the circulatory system, sundry other results might follow. To be clear, these groups of biocides were in no way meant for normal consumption by man, nor was man so constructed to be normally exposed to them with the expectation that it would improve his health. It is safe to make the general statement that these chemicals should always be used with caution.

It is also necessary to be more specific. It is to be recognized that the effects on human health produced by different biocides can and do vary over a wide spectrum from being relatively innocuous at prolonged exposures at relatively high concentrations to considerable toxicity or damage at low concentrations and short-term exposures. From this point of view each chemical must be considered in detail and precautions taken relative to the needs and properties of that specific substance.

Similarly the chemical formulation on the market may contain a solvent or carrier for the chemical and this in itself may be harmful to human health. Thus it may require specific attention and should be included in the assessment of the adverse effects of chemical pesticides on the market, in particular with respect to ingestion type of accidents and first-aid.

It should also be made clear that human health has often been protected by the use of pesticides. Malaria, bubonic plague, Rocky Mountain spotted fever and sleeping sickness are examples of serious diseases that man can be exposed to through the intervention of insects or other species that carry the infection. There is a long history of man's struggle with these problems; there have been considerable successes, and the situation in a general way is well known and reasonably well

understood. The use of biocides, particularly insecticides, has played an important part in controlling or eliminating the populations of disease-carrying species in some of the regions where man is exposed to such diseases. However, the emphasis in this section is on the hazards rather than the benefits to human health. The hazard is generally a result of direct response to the chemical while the benefit is an indirect result.

2.3.1 Pesticides in Foods

The plethora of chemicals available to man can appear in human foods through a number of ways and it is therefore prudent to carry out continuing quantitative analysis of foods to ascertain the degree of contamination. The Bureau of Chemical Safety, an agency of the Federal Department of Health and Welfare has carried out such work over a period of years and has published the results for the years 1971-73 inclusive, which are presented in Appendix V of this report. See for example the data for Aldrin plus Dieldrin, BHC (gamma), BHC (total), Heptachlor plus Heptachlor epoxide, diazanon, parathion, dicofol and captan in Appendix V. In general, there are minor indications that a few chemical contaminants are appearing in higher concentrations in some foods as time passes. The modest increases in frequency and concentration of those contaminants in foods are to be taken as a warning sign.

The examination of data gathered on a random basis across the nation and the interpretation of such data presents some problems. It is difficult to determine which products have been imported and which products have been raised on imported feeds. Clearly, the resolution to the problem of chemical contamination lies in the determination of the origin of the food or feed and the elimination of such sources.

The results of all such samplings should be made available to the public. There is a natural fear by some agencies that the public is not competent to evaluate the test results in terms of real danger to human health. Although this may be partially true, the advantage is that the public will educate itself, assist in the process of eliminating those products which may jeopardize human health and thereby become better able to protect itself from health hazards. In the Authority's view the advantages are clear and quite outweigh the vague fears and apprehensions of some. The Authority appreciates the fact that it was finally given clearance to release the data that appears in Appendix V.

RECOMMENDATIONS

- (1) That random checking of foods and feeds for chemical contamination be continued and intensified.
- (2) That identification of sources of chemical contamination become an important element in normal checking with a view to eliminating unsatisfactory food and feeds and the causes of the contamination.
- (3) That data concerning the frequency and level of chemical contaminants in food be made public.
- (4) That work be accelerated to establish safe acceptable tolerance levels for each chemical contaminant in food and feeds.
- (5) That federal/provincial cooperation be continued, encouraged and increased in the gathering and dissemination of food contamination data.
- (6) That federal and provincial agencies be commended for the improvements they have brought about in sampling for and establishing safe levels of tolerance.

2.3.2 Specific Reactions that are Cumulative, Hidden or Delayed

Evidence was submitted during the hearings that some biocides can act somewhat more insidiously to affect cellular processes or become involved in the chemistry of the nucleic acids in the human body. Although the precise mechanisms by which these occurrences come about may not yet be clearly known, scientists gave evidence and reference where certain biocides were shown to have carcinogenic effects on man or cause mutations presumably by an alteration of the chromosomic structure or to alter the normal growth pattern of a fetus in a pregnant woman so as to produce a deformed infant at birth.

The Authority was also informed of the growing scientific view that a chemical able to induce one of these changes in man is then statistically more likely to be able to induce one or more of the other changes. Since some of these hazards to the health of an individual or of successive generations can lie dormant for long periods of time,

this attribute in a chemical becomes all the more difficult to determine. Time, as well as expense, become important parameters in the solutions of the problem. If a chemical is able to induce a change of this sort in one species there is a considerably increased probability that it might also create similar effects in other living species but the increased probability does not in itself constitute a proof.

Methods of improving both the reliability and the speed with which man can determine the presence or absence of this factor in a biocide were discussed and there seem to be grounds to believe that techniques are continuing to be perfected and improved. These sorts of hazards are frightening and the implication that they might occur has no doubt been used in subjective ways, particularly when no definite evidence one way or the other was available in respect of a particular chemical. Because of its emotional impact, considerable confusion has resulted in public discussions at times. A good deal of confusion may still remain. Even the technical names for these groups of substances, namely, carcinogens, teratogens, mutagens, may seem a bit much. The hazards they pose, however, are real and must be guarded against.

A disturbing part of the picture is the reluctance both companies and government show in giving full information as to the possible health hazards that might be associated with any specific chemical. Some of this might arise naturally since in almost all of the testing other species are used to stand proxy for man. The Authority is of the view however, that this is insufficient reason to withhold full and public elaboration of known as well as potential health hazards that might be associated with the use, in the short or the long-term, of chemicals in pest control programs.

Evidence was presented to the Authority that techniques are now available to quickly determine whether a chemical has or has not a potential to produce carcinogenic, teratogenic or mutagenic effects. Following the general test, which is based on the use of bacterial, fungal and animal cell cultures, more specific tests need to be run on the suspected chemicals to determine whether, and under what conditions, the potential capability manifests itself. If such a screening method was to prove out a considerable advantage would be obtained from its application. The suggestion would be that chemicals with a potential for damage, as shown by the screening test, would not be used until and unless positive proof to the contrary was demonstrated.

RECOMMENDATIONS

- (1) That pesticides, herbicides, fungicides, insecticides, vertebrate poisons, growth stimulants and related chemicals be recognized as a class of chemical substances potentially hazardous to the health of humans.
- (2) That all such chemicals be used with caution and with careful attention to regulations and recommendations for their safe use and for the protection of human health, both of the applicator and of others.
- (3) That chemicals be placed into categories descriptive of the degree of hazard they present to life forms, including man, and that these categories be used both in identifying the chemical and in constructing regulations for marketing and using the chemical. (See also recommendations 6-14 section 2.3.4.)
- (4) That techniques now being investigated that might more quickly screen out chemicals with a potential for carcinogenic, teratogenic or mutagenic effects be followed closely and adopted when and if proven out.
- (5) That chemicals with a potential for various hazards to human health as in (3) above not be released for use until positive proof of safety is established.
- (6) That more efficient and more rapid ways of conclusively proving out the possible carcinogenic, teratogenic and mutagenic capabilities of biocides continue to be sought and that chemicals known to be hazardous be withdrawn in a rigorous and comprehensive way.
- (7) That the principals of freedom of information be considered paramount and that any reluctance of government or of industry to make all information about the effects of chemicals on the health of life forms, including man, easily, amply and fully available to the public and to individual members of the public including research scientists, be defined as an act against the best interests of the public and deplored as morally indefensible.

- (8) That full public disclosure of all known and potential health hazards associated with any particular chemical be released without restriction to the public both by appropriate government agencies and the company engaged in the marketing of the chemical.
- (9) That the study of the effects of chemicals include the study of the effects of the breakdown products or residues of the chemical and also the effect of the increased concentration of the chemical and its products and residues which can occur in the food chain process.

2.3.3 Uncommon Health Impairments

Evidence has been accumulating that some people may suffer genuine, even acute health impairments, from an exposure either intermittent or chronic to lower than usual concentrations of the class of chemicals under discussion. A full understanding of their reactions has apparently not yet been reached, though they may well have an allergic base. Sufficient evidence has accumulated however to make this an area of genuine concern. Medical science provides well documented cases that seem to be clearcut in which an individual reveals extraordinary reactions to the presence of minute amounts of chemicals that bring out no comparable response in other individuals exposed to the same circumstances. There seems some grounds to suspect that people with certain kinds of ailments, including respiratory ailments, older people and infants, may be more susceptible. There is also some evidence to indicate that an individual can become sensitized by continued low level exposure. The problem seems quite general and has been noted elsewhere at roughly the same time as it was being presented to the Authority.

RECOMMENDATIONS

- (1) That the unusual sensitivity of some individuals to low level concentrations of chemicals in the class under discussion be taken seriously and recognized as possibly legitimate complaints even though most people remain unaffected.
- (2) That pesticide applications, when necessary and particularly in urban areas, be responsive to needs of such hypersensitive citizens by avoiding broadcast or aerial spraying in general and by the use of closely space controlled applications in the vicinities of schools, hospitals, and retirement homes in rural and urban areas.

- (3) That the unusual sensitivity of some individuals to low level concentration of pesticides be given a higher priority than it now has among the problems in environmental health still needing further study.
- (4) That attention be drawn once more (E.C.A. Report and Recommendations. *Environmental Effects of the Operation of Sulphur Extraction Gas Plants in Alberta*) to the general indifference shown by medical research and the medical profession to environmental health problems and that the medical profession in Alberta be once more urged to join the rest of society in studying and solving the health hazards arising out of environmental stresses.
- (5) That a course in environmental health including the effect of pesticides on human health be incorporated into the curriculum of medical faculties.

2.3.4 Health Effects on Average Individuals

Some biocides derived from or making use of familiar chemical poisons like cyanide, arsenic and strychnine are used or have been used in pest control programs. These are also poisonous to man under conditions that are probably not always accurately described in murder mysteries. Other biocides like aldrin, lannate, chlordane and DDT are becoming more familiar as chemical agents that are harmful to humans, while still other compounds like sodium fluoroacetate (compound 1080), thiram, dieldrin and heptachlor are still not well known to the public at large but may pose a considerable risk to vertebrate species including man. Reference here is to health impairments arising either from immediate reactions with the respiratory or circulatory systems or other specific systems or organs in the body, or through the slow accumulation and subsequent reaction with the body or some part of it by the original chemical or metabolic by-products of the original chemical with results that may be minor, temporary, lasting or terminal to the exposed individual.

It is clear that biocides used in pest control have both positive and negative qualities in respect of food production and in the health and welfare of people. Many of the problems associated with the application of these biocides can result from misuse or overuse, and in these instances the possibility of health impairment is diminished if proper precautions are followed. With toxic substances however, more effective control mechanisms than label instructions and warnings would be required to safeguard human health. These kinds of biocides do vary widely from low

to extreme in their relative hazard to the health of people. A system that classifies chemicals to reflect this range of hazard would be beneficial as part of the registration, labelling, marketing and use of these materials.

Since the effect on human health of these groups of biocides is general to the average person, it would be appropriate if biocide management programs were established at the federal level through federal- provincial cooperation and coordination to permit use as required but to limit potential misuse and hazard to the health of individuals through adequate legislation, education, training and control systems. These should be made effective at the provincial level.

RECOMMENDATIONS

- (1) That to protect citizens from health hazards, biocide management mechanisms beyond label instructions and warnings, are required.
- (2) That since biocides vary in their effect from low to extreme on human health, a classification scheme reflecting this range of hazard be included in the registration, labelling, marketing and use of the products.
- (3) That programs to manage the use of biocides in a way that will adequately protect human health and the environment be worked out at the national level through federal and provincial cooperation and coordination, but with responsibility for enforcement at the provincial level.
- (4) That the biocide management program be worked out so as to permit required use but eliminate hazards to human health and to the environment that might arise through use or through the misuse of biocides.
- (5) That amended legislation, regulations, education and new and effective training and control programs be component parts of such a biocide management system.
- (6) That pesticides be grouped into six categories, namely: (i) highly toxic (ii) possessing carcinogenic, mutagenic, or teratogenic potential (iii) toxic (iv) highly hazardous to health (v) hazardous to health (vi) low health hazard. It is to be expected that ultimately all, or most, pesticides will be found in this last category.

- (a) highly toxic substances are those having an estimated human LD50 of about 50 mg/kg or less.
 - (b) toxic substances are those having an estimated human LD50 in the range of about 50 to 500 mg/kg.
- (7) That pesticides in categories (i) and (ii) be banned from use except for research purposes.
 - (8) That pesticides in categories (iii), (iv) and (v) be controlled by prescription.
 - (9) That prescriptive use require need to be shown, and that limits on use and transferability be imposed.
 - (10) That prescriptions be issued by qualified personnel who have gained accreditation from training programs in appropriate post secondary educational institutions in cooperation with the Pesticide Chemicals Branch of the Department of Environment.
 - (11) That district agriculturists and agricultural service board personnel be considered suitable for accreditation to issue prescriptions in rural areas.
 - (12) That outlets for prescriptive pesticides in urban areas be limited by licence and prescriptions filled by personnel accredited as in recommendation (10). The licence is to be issued by the Pesticides Chemicals Branch of the Department of Environment.
 - (13) That sales of prescriptive pesticides be a matter of record by the vendor in name of the user, amount, date, location and the nature of the prescription.
 - (14) That the name and emergency telephone numbers of all licensed sellers of prescriptive pesticides be made available to all poison control centres in the province.
 - (15) That sales of all pesticides be a matter of record at the retail level in matter of amount and reported under The Agricultural Chemicals Act.

2.4 PESTICIDE USE in ALBERTA



2.4 PESTICIDE USE IN ALBERTA

Albertans, through public and private use in many segments of society, have become greatly involved with chemical pesticides. While gaining much in the way of material benefits through their use, they have also shared the environmental and human risks and accidents that have marked the history of pesticide use elsewhere. Currently in the province a great variety of pesticidal formulations ranging from liquid sprays to granular solids are being employed in agriculture, manufacturing, recreation, domestic and other fields. Due to wide differences in the physical resources of the province, human population patterns and diversification of activities, a large variation exists in the type of pesticide used, the degree and intensity of use and its intended pest target.

Pesticides are being used in a great number of situations. Fungicides may be found in the home environment as wood preservatives and in agriculture as seed dressings. Insecticides are being used collectively and singly for such purposes as province-wide warble fly control programs and sporadic control of houseflies. The range of uses of herbicides extends from roadside brush control and aquatic weed control in irrigation ditches to lawn beautification. Vertebrate poisons are currently applied to the control of larger mammals such as coyotes as well as to birds such as Magpies and English Sparrows.

It is likely that nearly every adult Albertan uses a pesticide of one type or another from time to time, such is the extent to which they pervade everyday activity in this province. Although anyone applying a pesticide for a fee must be licensed by the provincial government, by far the majority of applicators do so on their own initiative and with few guidelines, apart from the instructions provided on the pesticide label. Consequently the use patterns for pesticides across the province are difficult to determine. Sales figures for Canada estimate that agricultural pesticides provide more than half the sales revenue when compared to home and garden products and industrial pesticides. It is very likely that the number of urban dwellers using pesticides far exceeds the number of industrial and agricultural users. It is of course difficult to relate the number of people using pesticides or the sales value to the actual amount of pesticides being used.

The rationale for pesticide use also varies in Alberta. The decision on the part of an individual to use a pesticide will depend upon a variety of inputs, among which are prior experience, expected

benefits, cost of application and available alternatives. A pesticide is most frequently applied to check a pest outbreak but there are many occasions when they are used as an insurance against potential pest damage. Pesticide spraying, on a large or small scale, is usually applied from ground or air. Pesticides are also available in aerosol spray cans, in solid sticks and granules.

Governments at all levels in Alberta are involved to some degree in pesticide use. Various provincial departments are engaged in enforcing the regulations laid down in The Agricultural Chemicals Act and associated provincial legislation governing use, sale and application of pesticides and the control of pests. Municipalities and counties enforce by-laws on the control of specified pests and cooperate with the provincial governments to operate widespread programs such as those for rat control and grasshopper control. Through extension programs and other practices the various government levels of the province share in the responsibilities for sound and judicious use of all types of pesticides which have been registered for sale in Canada by the federal government.

2.4.1 Regional Variation within the Province

A wide geographic variation in the use of pesticides in Alberta extends from the regional scale down to the individual household, farm and factory. Such variations became evident throughout the public hearings and need to be considered in any evaluation of pesticide use in Alberta.

In all activities in which pesticides are employed, a wide regional variation in use patterns was detected which undoubtedly reflects the type of activity and the biological pest specific to that activity. Regional variations in activity and in pest types and numbers can in turn be associated with variations in climate, soils, drainage and other physical attributes as well as the life cycle of the pest and its natural predators and the cultural practices of the applicator or operator. In agricultural activity the Authority heard of problems specific to southern Alberta such as weed control in irrigation systems and insect control in sugar beet fields. Grasshopper control practices were considered necessary by southern Alberta farmers but not by those from areas where grasshoppers do not invade in large numbers. Discrepancies existed in the amounts of herbicide used for roadside brush control among counties; and not all counties considered warble fly control in cattle to be a necessity. Urban areas also differed in the degree of intensity to which mosquito control programs were carried out.

Within a region or district there were inevitable differences in use between urban and rural dwellers. The Authority found that farm uses were governed primarily by economic factors related to cost of pesticide application versus anticipated benefits of crop or livestock yield whereas urban uses varied more according to convenience of use and the degree of citizen complaints rather than economics.

Finally on a smaller scale, there were differences among all users with respect to perceived impact of pesticides on the environment, perceived level of pest infestation and individual tolerance of pest infestations. All of these factors tended to produce variations in use within an individual household, between neighbours and among neighbourhoods of any town or city.

Regional variations of this sort as to the type of pesticide used, the intensity and frequency of application certainly add to the complexity of formulating recommendations on pesticide or biocide use in Alberta. For this reason, argument and recommendations will be developed separately for pesticide use in agriculture, in forest management, in the urban environments, in industry and in the nursery and greenhouse trade. These will then be brought together when appropriate in discussions and recommendations dealing with legislation and regulations.

RECOMMENDATION

- (1) That the wide and varied use of pesticides and herbicides in Alberta be recognized as well as the need to manage these uses wisely so as to provide maximum benefit and suitability to the needs of the different regions of the province, to avoid or minimize conflicts or other disadvantages in use and to limit or eliminate secondary or long term impairments arising from the use of those chemicals.

2.5 AGRICULTURE and the RURAL ENVIRONMENT



2.5 AGRICULTURE AND THE RURAL ENVIRONMENT

The agricultural industry remains basic to the economic health of the province. Though other sectors of the economy have strengthened over the years, agriculture continues to account for the greater proportion of Alberta's economic activity and employment. In Alberta the diversity of output includes cereal grains, feed crops, oils and fibres, sugar, honey, livestock, poultry and dairy products. In many parts of Alberta the farm unit is essentially a mono-cultural enterprise producing only one or two crop types with a minimum of labour input and a maximum reliance on labour-saving tools, equipment and energy fuels. Good mixed farming is still to be found but the transition of the family farm into so-called "agri-business" has encouraged the producer to expand the size of his operations in terms of investment in land and machinery to such an extent that continuous high crop yields are vital to the economic health of the farm. As a result of these factors, agriculture has come to depend even more heavily upon pesticides, fertilizers and fuels as the most economical and labour-saving methods of maintaining productivity and minimizing crop and livestock losses. It is therefore the economics of modern farming operations, including reliance upon a mono-cultural system, that makes the agricultural sector the largest volume user of pesticides in Alberta today.

For the last 15 years there has been an accent placed upon increasing the size of farms and the elimination of the smaller farms. The trend is clearly recognized in that from all levels of government, the way in which financial assistance is awarded, has the effect of reducing the number of farms and also the number of families involved in farming. It is time now, to re-evaluate this process in the light of the increasing dependence upon chemicals and the greatly increased costs associated with their use. The large corporate farmer is frequently involved in only a limited number of farm productivity capabilities and, as a result, good mixed farming practices which can greatly decrease agro-chemical use are decreasing.

While the real and potential threat of major economic losses from pest damage is a prime incentive to use pesticides and is emphasized through commercial advertising and extension literature on chemical pest control practices, the methods used in determining these losses are not always free of errors and assumptions to conclusively prove that the massive pest control programs in the past were fully warranted. Government-encouraged programs of wolf and coyote control, of warble fly control and of grasshopper control became the subject of much discussion in this respect during the public hearings, as did individual farm use of wild oat herbicides and seed treatment fungicides and insecticides.

Of additional importance is the fact that while following the dictates of economic costs versus benefits, the individual farmer may have no guideline to determine the degree of damage a pest can inflict before economic losses begin to be serious. For some crops in Alberta such "economic damage thresholds" have not been established and the individual operator either takes his chances when to spray his crop, or works on the "insurance approach" whereby the pesticide is used in the event that an infestation might arise. The latter approach accepts the cost of application as the cost of insurance regardless of the balance of costs and benefits in any one year. This practice applies to the use of many pesticides in Alberta.

RECOMMENDATIONS

- (1) That a careful re-assessment of optimum farm size be carried out with a view to decreasing the high dependence on an increasing number of agricultural chemicals that results from the trend to larger units including corporate farms.
- (2) That research toward establishing an economic damage threshold to provide guidelines for pesticide use receive increased attention.
- (3) That farm management techniques that protect the integrity of the family farm unit and of rural communities be encouraged and innovative and comparative studies such as are needed to achieve this end be carried out. (See also section 2.1.1.4 recommendations 11-15.)

2.5.1 Fungicides

Various plant diseases are capable of affecting crop production and the use of fungicides has been cited as one of the many, if not the major factor in contributing to reductions in crop losses from rusts and head smuts in cereals and from bunts, blights, root-rot, seed decay, mildew and damping-off in other crops in Alberta. Smut losses in cereal crops, for example, have declined from 20% to as little as 2% of the yield in the past 70 years due to a combination of factors including fungicide use.

In Alberta fungicides are used mainly as seed dressings for cereal crops and in smaller amounts for potatoes and the seed of flax, peas and sugar beets. Seed treatment is performed in municipal

seed cleaning plants and by individual farmers. The fungicides are used primarily as liquids or dusts and may be in single-ingredient or double-ingredient form. They are also used in combination mixtures with insecticides as dual-purpose formulations. Mercurial compounds were the most commonly used seed treatment fungicides prior to 1970 when environmental concerns led to the cessation of their manufacture and importation. Non-mercurial compounds such as Carbonix and Thiram are currently in use against plant diseases in the province.

2.5.1.1 The Use of Fungicides

The use of fungicides remained a subject for debate throughout the hearings and was discussed again at the meeting of scientists after the hearings. The problems arise because fungicides, particularly in seed treatment for smuts, are used as a preventative treatment before there is actual proof of disease. In some minds these are not necessarily sufficient reasons for treatment. Part of the objection is that the effect on non-target species, specifically beneficial soil fungi responsible for breakdown of organic matter and birds that may eat the seeds, have been ignored. Other hazards, including accidents when treated seed gets mixed up in feed grain, emphasize the need for using the least toxic fungicides, avoiding overtreatment, using seed treatment plants or co-operatives and encouraging biological controls such as the use of resistant strains. There is still a need for background data on the effects of fungicides on non-target species such as beneficial soil fungi.

RECOMMENDATIONS

- (1) That in the use of fungicides for seed treatment, emphasis be given to the use of the least toxic chemicals and that overtreatment be avoided.
- (2) That every care be taken to maintain the separation of treated from untreated seed, including the use of seed treatment plants rather than home treatment whenever possible.
- (3) That all necessary precautions be taken to avoid off target exposure in the use of fungicides for seed treatment.
- (4) That past successes in the development of resistant strains be recognized and that renewed efforts to develop new and more resistant strains be undertaken.

- (5) That more background data be obtained about off-target effects of fungicides, particularly those used in seed treatment.
- (6) That seed treatment in seed treatment plants, including co-operatives, be encouraged because of the advantage of improved control including the avoidance of overtreatment or undertreatment and in the more certain separation of fungicides and treated seed from untreated seeds, or exposure of animals and farm families to fungicides.
- (7) That farmers be encouraged to store unused treated seeds in separated, clearly labelled bags or bins.

2.5.2 Insecticides

Certain insect species in Alberta are considered pests of crops and livestock and are controlled with pesticides as well as by other non-chemical practices. The nature of insects is such that the possibilities of appearance of a new pest species and of the recurrence of severe infestations of old ones is always present, depending on such factors as cropping practices, weather, introduction of new crops and existence of natural predators.

Insects can cause actual loss of a product and reduction in its value from spoilage or loss of aesthetic appeal and can occasionally cause infection of crops by transmitting certain plant diseases. Significant insect pests to crops in Alberta are the grasshopper, the flea beetle, the cutworm, the Bertha armyworm, the beet webworm, the alfalfa looper, alfalfa weevils and aphids, all of which are capable of explosive population increases and have produced or threatened to produce large economic losses to agriculture on past occasions. Insecticides of the contact and systemic type have been used in a wide assortment of formulations, concentrations and physical forms for the control of visible pest outbreaks.

Other insect species are considered pests of livestock in Alberta and are subjected to insecticidal control. Livestock are treated for infestations of warble flies, horn flies, lice and ticks, all of which can affect livestock production. Ninety-five percent of cattle in Alberta are in "Warble Control Areas" set up by counties, municipalities and Improvement Districts with financial support from the Provincial Government. In northern Alberta, blackflies are a limiting factor in

cattle production, due to their reported adverse influence on weight gain, fertility and general health of the animals. Elsewhere in the province, livestock are occasionally affected by extremely high densities of mosquitos and biting flies.

2.5.2.1 The Use of Insecticides

There tended to be agreement that insecticides, though necessary, could be used with reduced hazard. Improved precautionary methods, qualified applicators and early warning methods would reduce risks from aerial spraying. Larvae treatment was in general preferred over fogging of adults. In general, there was a need for more evaluation of off-target effects and how they could be avoided or minimized, both in respect of damage to beneficial insects such as bees and to non-insect species such as birds. There is evidence in honey production that the insecticide build-up was more in the wax than in the honey. In general, insufficient attention has been given to identify the source of chemical contaminants in food and feeds in Canada. (See section 2.5.3.2.1 for a further discussion on bees.)

RECOMMENDATIONS

- (1) That, though the need for insecticides will continue, steps should be taken to reduce the hazards associated with their use, including improved precautionary methods, use of qualified applicators, early warning methods, emphasis on larvacides as against insecticides and a de-emphasis on aerial spraying when possible.
- (2) That data on off-target effects be gathered in western Canada and in Alberta, particularly in respect of honey production, insecticides as accidental avicides and the appearance of pesticides in food products. (For specific recommendations on bees see recommendations under section 2.5.3.2.1.)

2.5.3 Herbicides

Judging from Canadian sales figures for all pesticide products, more money is spent to control agricultural weeds than any other pest. The same is probably true for Alberta, where herbicides are used in a

wide variety of situations to control the unwanted vegetation that competes with cultured crops for space, water and soil nutrients. Herbicides are considered essential by most farmers for effective weed control. Herbicides are also used extensively for rural roadside spraying to control noxious weeds that might spread to adjacent fields. Some herbicides are also used on crown land for brush control and they are used regularly to clear aquatic weeds from irrigation canals in southern Alberta. Except in the latter case where a permit is required, herbicides can be used at the discretion of the individual farmer on his own fields and adjacent rights-of-way.

The most commonly used herbicide in Alberta is 2,4-D a relatively short-lived formulation for broad-leaved weed control in cereal and flax crops. Since its introduction in 1946 the number and use of herbicides has increased rapidly. The more persistent perennial weeds can now be controlled by longer-lived soil treatment herbicides such as Picloram. The wild oat, considered the major agricultural weed problem in Alberta, can be controlled either by a soil treatment or by a post-emergence treatment.

Herbicides are used in Alberta for economic reasons because many weeds have been introduced to Canada and have no natural control. Herbicides are generally applied on an "as required" basis on individual farms. This is also true for roadside spray programs that eliminate noxious weeds; however, incidents of use when the problem was not present were reported during the public hearings.

When plant pests conflict with the aims of efficient livestock production, herbicides tend to be applied. An estimated 100 plant species found in Alberta pastureland are cited as potentially poisonous to livestock, depending upon the nature of the range, the degree of grazing, the time of year, weather conditions and other factors affecting the grazing habits of livestock. Where plants such as larkspur, death camas, water hemlock and monkshood are found on a private grazing area, a rancher may use selective herbicides for control purposes. Where grazing leases are held in crown lands and forest reserves, this practice has also been used. In general, good range management has eliminated the need for anything more than an occasional spot treatment with herbicides.

2.5.3.1 Effects on Off-Target Species

The implication that herbicides only affect plants, that insecticides only affect insects, and that vertebrate poisons only affect vertebrates,

etc., is suggested by the terminology but there is considerable evidence that chemical effects are not so easily compartmentalized. Some well documented cases are apparently firmly established. Evidence was submitted at the hearings that insecticides can sometimes act as accidental avicides and that herbicides can sometimes act as accidental insecticides, etc. In the first case there was evidence that insecticidal spraying in the ravines could and did cause the death of birds, more specifically of young birds still in the nest. The evidence indicated that it was direct exposure to the spray rather than the consumption of dead insects which had been sprayed. There are further references in the scientific literature to this matter. (See recommendations concerning accidental avicides under Section 2.6.2.)

2.5.3.2 The Use of Herbicides

As the hearings progressed, two points of controversy seemed to merge. This may be reflected in the statement that, though the effect on the target species was the primary concern, the off-target effects had to be studied in their own right but this had not yet been done satisfactorily in Canada or the Canadian west. As well, it was now appropriate, in view of increasing costs as well as expanding knowledge, to move towards methods that would reduce the need for herbicide use. These would include maintaining some rights-of-way as wildlife habitats and in reckoning the economic loss as well as the gain to be derived from herbicide use. Other occurrences such as aerial drifting of herbicides into water bodies, or herbicide pick-up by bees leading to injury to larvae, were indicative of use conflicts that still needed resolution.

RECOMMENDATIONS

- (1) That, though the effect on the target is the primary objective of herbicides, the off-target effects need to be studied in their own right and have not yet been given sufficient attention in Canada or the Canadian west.
- (2) That more thrifty use of herbicides be encouraged and that conflicts between target and off-target effects be resolved.

2.5.3.2.1 Effects on Honeybee Production

Evidence was also submitted to the hearings that certain herbicides, specifically 2, 4-D, could cause the death of bees in pre-adult stages within the hives. The adult bees, foraging for nectar, would pick up traces of the herbicide and then introduce it to the feed and water provided to the brood. Death of the brood would result in the consequent depopulation of the hive and loss in honey output to the apiarist. The Authority is of the view that definite cause and effect proof had not yet been established for this claim but that sufficient documentary evidence was put before the Authority to warrant giving this matter priority.

A series of specific recommendations was put forward by apiarists to handle the problem. The Authority endorses these recommendations in large part but also recognizes that their achievement will require the cooperation of the different kinds of farmers in any region including the bee farmers themselves. The off-target effects of insecticides on bees have already been referred to in section 2.5.2.

RECOMMENDATIONS

- (1) That beekeepers who wish to protect their bees from pesticide injury shall report the location of beehives to the District Agriculturist.
- (2) That pesticide applicators, prior to spraying, shall obtain information of beehive locations within a one mile distance of the proposed spray area from the District Agriculturist.
- (3) That pesticide applicators shall notify all beekeepers within a one mile radius of the proposed spray area of the spray plans, not less than 48 hours prior to spraying.
- (4) That appropriate structured research be undertaken to determine whether herbicides do have adverse effects on colonies of bees and if so, what steps should best be taken to resolve the conflict.
- (5) That the Pesticides Chemicals Branch be the repository of information on a province-wide basis of the location of apiaries and the effects on their operation of spray programs by licensed operators.

2.5.4 Vertebrate Poisons

Several species of wildlife come into regular conflict with agricultural interests and have been designated as pests under Alberta legislation. Wolves, coyotes, skunks, rodents such as ground squirrels, pocket gophers, mice and Norway rats, several species of fish as well as crows and magpies are subject to control through vertebrate poisons in Alberta. In some cases control is mandatory. In other cases special officers such as the Predator Control Officers of the Alberta Department of Agriculture undertake the responsibility for control. The Alberta Fish and Wildlife Division has been active in predator control.

Livestock predator control has been principally aimed at the coyote for its reported preying upon sheep, lambs and calves. Pesticides used against the coyote are currently restricted by law to strychnine, cyanide guns and compound 1080 (sodium fluoroacetate). Strychnine has also been used on wolves, whose prey is reported to include cattle, horses, sheep and domestic pets. Various rodents have been poisoned to keep down the high populations which are deleterious to grain production; and sporadic attempts have been made to regulate the populations of some birds such as blackbirds, cowbirds, starlings and magpies by the use of pesticides. Norway rats destroy agricultural produce through consumption, spoilage and destruction and there has been for the past 30 years in Alberta a control program, by the use of poison baits, to prevent these pests from entering the province from Saskatchewan.

Finally, poisoning campaigns against foxes, bats, wolves, skunks and coyotes have been undertaken in response to rabies outbreaks in Alberta. A rabies vector control program is currently ongoing in the province to eliminate skunks, reported to be vectors of rabies.

2.5.4.1 The Use of Vertebrate Poisons

There is some concern that vertebrate poisons can be overused or used when they are not really necessary. The psychological factor leading to overuse is associated with a notion that, under certain circumstances a species in a region should be exterminated as in the rabies control programs. There may well be undesirable overkills of bats, skunks and such other species as from time to time are identified

as rabies vectors since these animals play significant and useful roles in ecosystems. Vertebrate poisons often possess a wide spectrum toxicity to many vertebrates including man and his domestic animals. These poisons are to be used with great caution and indeed their use has been banned in some jurisdictions. Recommendations to ban vertebrate poisons were not made at the hearings but their use under prescription and only where need is shown has been suggested.

RECOMMENDATIONS

- (1) That all highly toxic vertebrate poisons be banned from normal use and be made available only under exceptional circumstances. Highly toxic poisons are defined as those poisons with an estimated human LD 50 of about 50 mg/kg or less. (See also recommendations under section 2.3.4 for details of control of toxic substances.)
- (2) That, because of the inherent danger to all vertebrates, including man, to reduce the hazards of misuse and of overuse all vertebrate poisons toxic to man be placed under use by prescription alone and where need is shown. Toxic poisons are defined as those having a human LD50 of greater than 50 mg/kg and less than 500 mg/kg. (See also recommendations 6-9 under section 2.3.4.)
- (3) That the cautious use and safe storage of vertebrate poisons be encouraged among domestic users.

2.5.5 Record of Use

The use of pest control products varies from year to year and from area to area. This probably complicates the assessment of the effectiveness of the product and the assessment of related effects. In any event the only required record of use in Alberta is that included in the Pesticide applicator's licence and is basically done to assess the performance of the applicator, not the performance of the product or of the side-effects, nor is the record directly related to a particular area or parcel of land. There is need for a continuing record of pest control products used in Alberta and one that will provide information on a provincial and regional basis for assessing the efficacy of the chemicals as well as their off-target effects.

RECOMMENDATION

- (1) That a record of use of all pest control products, showing amounts, regions of application, efficacy and off-target effects be developed by the Pesticides Chemicals Branch.

2.5.6 Field Assessment of Target and Non-Target Effects

Pesticides are registered under The Pest Control Products Act, 1970, for a maximum of two years and a nominal fee is charged for registration renewal. This act is administered by the Control Products Section of the Canada Department of Agriculture and some other Federal Government agencies participate in all or some of the product registrations. It is noted that there are some 6,000 products now registered and about 600 active ingredients are used. Therefore registration renewal is a relatively large job, 3,000 per year and at 250 working days, 12 per day. In addition about 300 new products are registered each year.

In view of the foregoing, it has been suggested that registration renewal tends to be somewhat automatic unless there is definite evidence that a detailed review is required. At the same time pressure for renewal would be expected while further studies are being carried out (if these were time consuming) and a strong need for the product existed.

Factors like these tend to minimize the assessment in the field or commercial use of pest control products. Recent examples of adverse or undesirable side effects discovered later include those arising from the use of mercury as a fungicide, arsenic as an insecticide and DDT as an insecticide. It must be accepted that field assessment follow-up would not be practical for all 6,000 of the registered products; however, those products which are being used in a commercial rather than a hobby or household manner could receive priority study.

The Authority is reluctant to suggest changes that make life more complex, unless there is a clear need for it. The marketing and use of agro-chemicals are activities which can present a potential threat to human health and safety or threaten the integrity of the environment. The extraordinary number of agro-chemicals on the market, the use of a multiplicity of trade names for the same chemicals and the minor changes in formulation which produce new trade names, are examples where the market place itself acts to make life more complex than it need be.

RECOMMENDATIONS

- (1) That the renewal of registrations of pest control products be based on field assessment studies for all products used in a commercial way for each of the first and second renewals and on an "as required" basis thereafter. Efficacy and off-target effects should be included.
- (2) That in view of the increasing cost of pesticides and the possibility of supply shortages in the short and long term, improved, and more thrifty control practices be encouraged.
- (3) That improved pesticide control practices be followed, even at the cost of some loss in productivity, when a threat to human health and safety can be apprehended.
- (4) That the registration and control of ever increasing numbers of synthetic chemicals be recognized as making sound environmental management more difficult and that systematic measures be taken to limit the total number and variety of these products on the market at any one time.

2.5.7 Agricultural Uses and Applications

Ever since the advent of agro-chemicals, the Alberta Department of Agriculture, the agricultural colleges and the universities have been helpful to farmers in working out effective ways to use the chemicals. The district agriculturists, the agricultural service boards and the agricultural colleges are to be particularly recognized for their major contribution to efficient farm use of agricultural chemicals. This has been proper and necessary but the strong emphasis on agro-chemical use may have detracted from the weight given to alternatives whose economic viability may now have improved as the chemicals have become more costly. The numerous factors which combine to create and support the trend to larger, more mechanized mono-cultured farms also increase the dependence on chemical farming. Both trends can produce unfortunate results in the longer term.

At the present time the farmer is still regularly bombarded with the advantages of chemical farming methods by the industry. There is no counter-balancing agency within farmers' associations or government, though some effort to make known some of the disadvantages of chemical farming is beginning. There is still a need to develop and present a

more balanced picture of the advantages and disadvantages of chemical farming. The decisions the agricultural community needs to make can then be done within a more balanced framework of knowledge.

Some relevant recommendations including a proposal for comparative studies of chemical and non-chemical farming, improved methods of application, off-target effects, the manufacture within the province of the pesticides the farmers need, etc., appear elsewhere in the report. Here, the Authority wishes to emphasize that the use of chemicals be examined and presented from the farmer's point of view, not only from that of industry or government.

RECOMMENDATIONS

- (1). That the need for farmers to be given a more balanced picture of the benefits and hazards of the use of chemicals be recognized and responsibility for it be accepted by farmers' organizations, relevant educational institutions and departments of government.
- (2). That the right of the farmer to make his own determination to use or not to use pesticides be recognized within such regulations as are needed to protect the rights and safety of others.
- (3). That the use of pesticides be systematically assessed from the farmers' point of view, including the benefits and disbenefits of using, and of not using the pesticides with a stronger emphasis on the advantages that non-chemical alternatives or integrated methods could provide, than has been done in the past.
- (4). That the off-target effects of pesticides including health hazards to the farmer and his family be a component of the balanced assessment of pesticide use.
- (5). That improved coordination and understanding be sought in pesticide use programs between the user, producer, seller, government and public to enable all groups to work together towards the common goal of the safest, thriftiest and most beneficial use of pesticides.
- (6). That the need for pesticides be recognized as a claim on non-renewable resources and that this factor be included in future assessments of resource conservation and economic gain from the use of pesticides and that advice from these assessments be made available to the public.

- (7) . That the manufacturer or importer of chemicals, with a potential for damage, be required to post with the government and make public, the name of the substance, the amount to be manufactured or imported, test results, testing methods and standards used, toxicity, alternatives to the substance, need for the substance and adverse health or environmental effects, including a proof that none exists, if that is claimed.
- (8) . That, if others do not, the province make available to the farmers and the public all information about pesticides relevant to their use and application, including off-target effects and any possible hazards to the health of humans.
- (9) . That a standing committee on improved pesticide control, including the integration of non-chemical methods in farm management, be established to develop pesticide use programs from the user's point of view.

2.5.8 Efficacy Testing of Pesticides Under Conditions in Canada and Alberta

Since almost all pesticides are manufactured outside Canada, and indeed developed for pests, circumstances and environments in those countries, questions arise as to whether the most effective pesticides for Canadian and Alberta conditions are being used, and whether tests relevant to circumstances in Alberta and in Canada are done to show absence of health and environmental impairments. After discussion throughout the hearings, the final meeting of scientists suggested that there indeed was a need for additional testing to prove out the efficacy and the safety in use of the pesticides in the conditions that prevail in Alberta. The need for regional validation was greater in respect of indirect effects, as on plant communities, on animal communities and off-target species. The consensus was that a need for more efficacy and off-target testing on a regional basis was needed in Canada and in Alberta than was now being done. The Authority supports this suggestion and feels that cooperative use of regional testing programs under federal and provincial auspices should also be encouraged. There is now a tendency for the governments to register a product, permit its release and then divest themselves of further responsibility.

RECOMMENDATIONS

- (1) That testing on a regional, climatic and soil type zone basis be done for efficacy, for health impairment, for food contamination and for off-target effects on pesticides imported into Canada.
- (2) That such test for off-target effects on plant and animal communities in Canada be done cooperatively and with exchange of information between federal and provincial jurisdictions.

2.5.9 Availability of Information on Pesticides

Scientists are experts in searching out information and building up and validating data from original sources and scientific literature. Despite this, there was a considerable range of views as to whether factual information known either to companies or to government was available, and if so under what conditions. In attempting to gain agreement on this point, it was quite clear from the outset that even scientists could not get hold of all scientific information companies might have, or that governments might have, and that it would be still more difficult for members of the public less experienced in tracking down information.

It was difficult to establish a rationale for restricting circulation of information about the hazardous effects of chemicals. The Authority was told there was some indication that individuals in companies or in governments had no wish to restrict such information. It was just not possible to get it out of the office, whether the restriction was an implicit or explicit policy directive. Indeed, in some circles information is treated as if it were a commodity on the black market, or to be smuggled through unspecified but serious barriers and boundaries. The document might be shown in draft form in an office, the title page might be flashed, you might be told of its availability 2,000 miles away but no closer. One might even photocopy it if it was not taken off the premises. There was also the information that was not shown. On the other hand, voluminous quantities of data are made available, a veritable flood of it, so part of the problem is simple mechanics in getting the stuff out.

In summary, it would appear that some government officials can get most of the information the companies may have. It is then easier for scientists in government service, or on government committees, to gain access to this information than for other scientists. It is still more difficult for non-scientific members of the public to get the kind of information that companies, or some government officials, apparently feel to be sensitive. There seems a need to clarify in the public's mind, as well as for the scientist, just what information is now available, as well as what is not. There seems insufficient reason to prevent the free flow of relevant information now being restricted at the company or at government level.

RECOMMENDATIONS

- (1) That clarification be given as to what information relevant to the use of pesticides from companies and from governments is available, and what is not. (See also recommendations 3 and 5 under section 2.3.1, and 7 and 8 under section 2.3.2.)
- (2) That companies and governments lift all restrictions on the availability of any information that in any way relates to health impairment or other environmental effects associated with chemicals now registered, or when registered, for use.

2.5.10 Efficacy of Chemical Pesticides

The question of the effectiveness of chemical pesticides, including the basis on which efficacy was judged and whether some chemical control methods were in use that were not effective in respect of the target, was discussed. It was agreed that objectives varied with the pest and that, in terms of the target alone, an economic objective was most desirable. In these terms some chemicals have been judged ineffective and taken off the market by government.

RECOMMENDATION

- (1) That the efficacy of pesticides be re-evaluated under normal farming conditions and be reapproved from time to time in respect of their effect on the target species and, as judged in economic terms, be taken off the market if they are ineffective, or information as to their ineffectiveness be made public.

2.5.11 Non-Chemical Pest Control Methods

Non-chemical pest control methods apparently held promise but research bottlenecks from lack of funds, even in developing resistant plant strains posed major problems. Biological controls such as the use of suitable predators and parasites, entomopathogens which cause diseases in insects, the manipulation of sex hormones to suppress insect breeding, control of insects by sexual sterilization and the development of morphogenetic agents in insect control, are other areas in which promising results for safer, more target-specific pest control practices are being developed. There are also many promising opportunities in non-chemical control of weeds. The non-chemical controls are at the research stage; they are still long-term, so commercial incentive is lacking. Government support of university research in the area is diminishing and graduates trained in the field have difficulty obtaining related employment. This emphasizes the difficulty in moving ahead with the research in universities so that the applied research still needed can follow.

The universities not only provide a basic step in the fulfilment of research needs, they also provide the pool of trained scientists from which government, industry and the universities need to complete the research and assist in the application of the proven methods in the field. Both of these roles have been put in jeopardy in Canada by a shortage of funds in an area of research that is so fundamental to Canada and its agricultural industry.

RECOMMENDATIONS

- (1) That increased funding for research and development into non-chemical pest control methods be provided to universities and increased research and development be encouraged in governments and in industry.
- (2) That encouragement to industry for research into non-chemical pest control procedures be given in the form of tax write-offs, cost-sharing programs and the like.

2.5.12 Adequacy of Existing Provincial Regulations

There was some agreement, or at least a lack of disagreement, that provincial regulations and legislation were either adequate to the need or with amendments, could be made effective. Recent and proposed

federal and provincial legislation would take some time to work its way into practice. The trend towards more stringent controls, particularly on some pesticides, would be expressed in present or amended legislation. Legislation had to recognize the practical fact that some misuse might occur even in good, well-managed systems and that though some pesticides might need prescriptive control, most probably did not. There was as well some possibility that both the number of formulations, now about 450 in Alberta, might stabilize or even be reduced. This would make it easier to handle the number of products on the market, particularly in urban areas.

In Alberta a new Agricultural Pests Act is to be proclaimed soon and a new Agricultural Chemicals Act is under consideration. There is a need for constant revision and upgrading of legislation in these matters. There is as well the need for effective coordination between departments so that legislation can be followed up and enforced. The Pest Chemicals Branch in the Department of the Environment needs additional staff. The sharing of responsibility, expertise and jurisdiction particularly between the departments of Agriculture and Environment is the key to a successful operation.

Though legislation has some merit, better programs are also needed, and the municipalities need the funds to carry out these programs. New program structure together with adequate funding are needed to carry out present and proposed legislation.

RECOMMENDATIONS

- (1) That more comprehensive implementative programs be developed to include participation at the municipal level and that necessary staff be provided for the Department of the Environment to carry out its responsibilities.
- (2) That the need to continually review and revise provincial and federal legislation be recognized, including Acts like The Alberta Agricultural Chemicals Act, The Alberta Agricultural Pests Act, The Canada Chemical Contaminants Act.
- (3) That for specific recommendations for inclusion in above Acts, see recommendations in 2.9.1 and 2.9.2.

- (4) That the legislation and regulations, suitably amended, be supported by the programs at the various government levels, including municipal, so that the intent of the legislation is implemented and all citizens are enabled to more cooperatively participate in its application and enforcement.

2.6 DOMESTIC USE and the URBAN ENVIRONMENT



2.6 Domestic Use and the Urban Environment

Registered domestic pesticides may be used in Alberta at the discretion of the user though label instructions are presumably to be followed. Unlike the farmer who applies for economic reasons and for adherence to various marketing regulations concerning pest infestations, the domestic user generally applies a pesticide for such purposes as maintenance of physical health and comfort and aesthetic appearance of home and grounds. However, in estimating economic damage for those types of pest problems where low level damage can be tolerated neither urban nor rural users are always in a position to make a decision based upon established guidelines. This presents another opportunity for abuse of the chemical.

Domestic users of pesticides in Alberta are predominantly urban dwellers although there are also rural dwellers who use insecticides, herbicides, etc., in their homes and gardens. The quantity of pesticides used for domestic purposes is in the order of 25% of the total purchased annually and is second only to agriculture in the value of sales. Unit costs for the chemicals are higher for urban than for farm users. The major purposes to which domestic pesticides are put are protection of health of humans and pets, maximization of physical comfort and outdoors enjoyment, aesthetic enhancement of lawn and garden, and protection of home vegetable production.

Insecticides are used to control nuisance insects such as houseflies, silverfish, flour beetles and cockroaches. Some of these insects present potential health hazards to humans and pets. Protection of textiles such as clothing, carpets and sheets has also involved pesticide use through such devices as "mothballs" and aerosol formulations. Some insects cause loss of comfort through bloodsucking and biting of human victims, and pesticides are used to reduce such sources of discomfort. Pesticides are also employed in gardens to control organisms that infest ornamental plantings, trees and vegetables. These may be small pack fungicides, insecticides, herbicides or combinations of these various types of pesticides. Fungicides such as pentachlorophenol also find domestic use as wood preservatives in fencing and other construction projects. Vertebrate poisons are employed on a smaller scale to control rodents such as mice. The owners of waterfront properties also have the option of using herbicides to control aquatic plants in adjacent publicly owned water bodies, provided a permit is obtained from the Alberta Department of the Environment.

In the case of home and garden use, the quantities of pesticides bought and used for any pest problem generally far exceed actual need. The pesticides are usually sold in concentrations that require dilution for certain applications and a general tendency is to apply at greater than recommended strengths and rates. Specifications are sometimes in terms difficult to understand or awkward to use. Their availability in a variety of formulations also tends to confound the domestic user's intelligent discrimination among products. The actual choice of the pesticide will depend on such varied factors as the degree of advertising of the product, packaging and convenience as well as the pest target's physical characteristics, feeding habits, life cycle and habitat. Probably the greatest impact on the consumer's judgment is the advice of sales persons who unfortunately in most cases are not qualified to advise.

Many households will have a variety of these potent chemicals in containers kept sometimes rather casually for year after year. A danger through accidental misuse particularly by children, but also by adults, certainly exists. The record of incidents in poison treatment centres shows some poisonings and even recurrences but not so many that new emergency measures seem needed. Poison centres now established seem to be working well. Reasonable educational programs, a more conservative use of the chemicals and good husbandry of the materials, all done in the home, seem the sensible way forward. There are, however, some chemicals that should not be used, some only on prescription and improvements in labelling and marketing procedures should be adopted, as has been recommended in other sections of this report.

RECOMMENDATIONS

- (1) That householders be encouraged to be more moderate in their use of pesticides, to inform the whole family of the risks and proper uses of chemicals on hand and to assure safe storage of any stocks on hand.
- (2) That highly toxic chemicals be banned, that toxic chemicals be available only on prescription and that sales outlets have qualified personnel to handle the prescription chemicals.
- (3) That all amounts mentioned on labels be such that the average users can measure the amounts easily, a possibility that will be more likely after conversion to the metric system.

- (4) That commercial outlets for pesticides be licensed by the Pesticides Chemicals Branch.

2.6.1 Community Uses

In the urban centres of the province there are a number of institutional uses of pesticides. Cities and towns undertake mosquito control programs and occasionally some vertebrate control. Urban municipalities also perform spot treatments with herbicides for maintenance of roadsides, parks, golf course and recreation areas. Soil sterilants are used at locations where no vegetation is wanted. Vertebrate poisons have occasionally been used by urban municipalities to eliminate nuisance birds, bats suspected as rabies vectors, rodents, etc.

2.6.1.1 Mosquito Abatement

Mosquito control is generally justified by cities and towns on the basis of complaints from citizens regarding physical discomfort caused by mosquitos, although the control of diseases like encephalitis and malaria is also cited. The use of insecticides in this program is directed at the larvae in their water habitat or at the adult in many of the vegetated localities that it occupies. The filling-in of wet low-lying areas is also an effective control procedure. The insecticide, malathion, is predominantly used in aerial spraying of adult mosquitos, although "adulticiding" is generally recognized as an inefficient control method due to the potential hazards to non-target organisms such as birds and beneficial insects, and the movement into the area of adults from unsprayed regions. Larvaciding is performed on a spot treatment basis at nearby potential breeding grounds.

The mosquito has been an urban pest in cities in the west and much attention, with steadily improving results, has been given to the control of this indigenous insect. Procedures have improved even since the hearings, resulting in a better control of the target species and less off-target damage. Spraying from aircraft to kill adult mosquitos, which may be a satisfying tactic to observe in an emergency, probably exerts a larger toll of non-target species, including man, birds and beneficial insects, than do other more carefully controlled and more target-oriented mosquito abatement programs. The urban centres in Alberta, particularly the City of Edmonton, where the problem has given rise to colourful complaints, are to be commended for the thoughtful effort

they are now displaying to control the mosquito population at tolerable levels, while continuing to diminish damage to off-target species. There is, however, still some way to go, including a further reduction in the use of aerial sprays from aircraft in ravines or near residential areas, a still greater emphasis on habitat reduction for breeding mosquitos, a de-emphasis, except in emergencies, of the use of adulticides, including the use of more target oriented chemicals, and the continual and improved use of non-chemical controls. Attention will still need to be paid to secondary effects of larvicide use, as more experience is gained.

RECOMMENDATIONS

- (1) That the cities in Alberta be commended for the good, thoughtful and increasingly successful procedures they have adopted to control mosquito populations and to reduce off-target damage to humans, to birds and to beneficial insects.
- (2) That the cities be encouraged to continue these improvements in both on-target specificity and off-target immunity.
- (3) That aerial sprays from aircraft to kill adult insects be further de-emphasized in the environs of the cities as alternate controls become more effective.

2.6.2 Accidental Avicides

The ill-effects of the use of pesticides on bird populations was presented to the Authority particularly in urban centres. The Authority was concerned enough about the problem to hold a special supplementary hearing to explore the question in greater depth. While it is true that some birds, under some circumstances, may cause damage to crops, their presence in an urban environment is more often encouraged by man, who take delight in their presence, and go to great trouble to attract and protect all birds or selected favoured species.

The discussion therefore dealt hardly at all with the deliberate control of bird populations by chemicals but rather with the accidental killing of birds when pesticides are used for other purposes. The use of avicides did arise during the hearings but only in a limited agricultural context and in connection with massive kills of less favoured bird species in other countries.

The concern expressed by urban residents dealt with the accidental destruction of bird populations when chemicals were used for other purposes. Birds move into cities, attracted by the products of the numerous and varied residential shrubs and forestry and by the feeding stations many citizens set up. These birds almost become pets and provide friendly company in summer and winter for many householders. Thus death or diminishment or the disappearance of colonies established through many years of careful nurture are events to be avoided, the Authority was told. It is also a view the Authority supports. The overkill of beneficial insects, the use of too persistent pesticides, aerial spraying that soak nestlings and frighten the mother bird away, excessive aerial spraying of wooded ravines and other practices damage bird populations even when there was no intent to do so. This is a process that acts like an accidental avicide and does damage that no one desires.

Urban residents also are concerned about other accidental avicides but in a different context. Game birds (and pheasants are the best known though not the only example) may also suffer population damage by accidental exposure to pesticides being used for some other purposes, for example, seeds treated chemically for crop control that are toxic to a seed-eating bird.

RECOMMENDATIONS

- (1) That the protection of bird life be accepted as an operating restraint upon insect abatement programs in urban areas and their environments. (See also recommendations under section 2.3.3 and 2.5.2.1.)
- (2) That increased populations of favoured bird species be encouraged in urban parks and areas by the introduction of feeding stations, bird houses etc. so as to help control insect populations and diminish the need for hazardous sprays.
- (3) That studies be undertaken to determine the effect of accidental avicides and of pesticide application procedures on bird life and populations.
- (4) That the use of persistent chlorinated hydrocarbon pesticides for insect control in urban areas be avoided.

- (5) That the use of aerial spraying for insect control in urban areas be restricted to special cases to avoid the double danger of accidental damage to birds and the fright producing effect of low-flying aircraft.
- (6) That pesticides, potentially harmful to birds, be localized by all possible means since pesticides accumulate in birds at a rate proportional to the amount present in a given area.*
- (7) That chemical seed dressings, that could produce adverse effects in birds, not be used in areas where seed-eating birds are predominant or at times when seed-eaters are abundant such as during spring and fall migrations.
- (8) That programs for monitoring the uptake and residues of pesticides in avian species indigenous to a sprayed area, be established by the Department of Environment in cooperation with the Department of Agriculture.
- (9) That when an urban area has to be sprayed with insecticide, as in the case of mosquito control, it be monitored for bird activity and population before and after spraying to determine whether detrimental effects have resulted.
- (10) That insecticides not be applied in granulated forms since birds may eat granules, thereby ingesting high concentrations of the pesticide.
- (11) That avicides not be available to the general public but their use restricted to licensed applicators and a permit to use issued for each specific instance.
- (12) That the public be encouraged to report incidents of bird mortality thought to be related to pesticide or avicide use.

*Stickel, L.F. 1973. *In Environmental Pollution by Pesticides*. C.A. Edwards (ed.) Plenum Press, London.

2.7 PESTICIDES in TRADES, INDUSTRY and MANUFACTURING



2.7 PESTICIDES IN TRADES, INDUSTRY AND MANUFACTURING.

The use and place of pesticides in special circumstances were presented during the hearings and merit attention. Reference is made to the nursery and greenhouse trades, to pesticide use by industry and to the manufacture of pesticides.

2.7.1 Nursery and Greenhouse Trades

The nursery and greenhouse trades are uniquely different from agricultural, domestic and industrial users of pesticides and are worthy of special attention in any discussion of pesticide and herbicide use in Alberta. The field nursery and greenhouse represent highly artificial environments for the production of specialized trees, ornamental shrubs, vegetables, cut flowers, and potted plants. The greenhouse in particular is almost a closed system under glass where temperature and humidity conditions are closely regulated to optimize growing conditions on a year-round basis. Such conditions are conducive to massive increases in pest populations. While some degree of pest control can be achieved through rigorous application of such sanitation measures as soil sterilization and inspection of new plants entering the greenhouse, chemical pest control is considered essential to the economic viability of the operation. Field nursery activities also include crop rotation, summerfallowing and hoeing but many operators still consider pesticides to be effective and economically efficient.

There are several interesting aspects of greenhouse use of pesticides. In a greenhouse, the use of a pesticide represents a confined use since very little can escape outside the confines of the building. In addition the year-round use of the greenhouse and its soil means that the operator applies pesticides, not merely on a seasonal or spot treatment basis but at regular and frequent intervals of one to two weeks throughout the year. As such, pesticide use in these closed environments is basically a preventative procedure based upon the anticipated economic returns from each crop. The objective is to protect the marketability of the product which depends upon its appearance and freedom from pest infestation. Returns from the greenhouse trade in 1974 were estimated to be \$11.00 per square foot.

Greenhouses and field nurseries use a variety of pesticides as well as fertilizers, growth regulants and other chemical formulations. Insecticides and fungicides tend to predominate in greenhouse use, whereas in the field nurseries 65% - 75% of the chemicals applied are herbicides. Target pest organisms include mealy bugs, mites, aphids, and tent caterpillars as well as those responsible for blight, mildew, root rot and damping-off diseases. Sod farms also fall into the field nursery category and these utilize herbicides to a considerable extent to maintain high product quality.

While the intensity of pesticide use tends to be greater in these trades than in agriculture and other industries, the actual volume of pesticides used is relatively small. With the smaller areas devoted to these land-intensive activities and the generally closed environments affected, pesticide use in the nursery and greenhouse trades is characterized by higher efficiency and is devoid of many of the chances of environmental hazards attributed to pesticide use in other activities.

It may well be that still greater use could be made of greenhouse systems as time passes to produce food for Alberta and the Canadian north and thereby replace the considerable import of foodstuffs from more temperate climates. Indeed the possibility of food shortages that might limit imports and increasing transportation costs, coupled with the high yields these controlled and self-contained environments produce even in cold climates, would suggest that a policy of encouragement to the greenhouse trade would be appropriate in Alberta.

There are problems from the use of chemicals in these closed systems, including the disposal of wastes, both water and soil, in which the concentrations of chemicals and their residues have become too high for further use in the greenhouse. It is suggested that in the overall, better and safer pesticide management is possible inside these closed systems than outside them.

RECOMMENDATIONS

- (1) That the advantages of using pesticides in closed systems such as greenhouses as compared with open environments be recognized and that the further development and expansion of the greenhouse industry on an efficient and well managed basis be encouraged.

- (2) That with the prospect of shortfalls in food imports the growth of competitive food products in greenhouses for the Alberta and northern Canadian markets be encouraged and that such innovations and field tests in greenhouse technology, as may still be needed in Alberta be supported by the government, to include the Departments of Agriculture, Business Development and Tourism and the Research Council of Alberta.
- (3) That some pesticides which are highly restricted for normal agriculture or urban use be considered separately for use in greenhouse applications with appropriate precautions prescribed for such use and for the disposal of wastes containing pesticide residues.

2.7.2 Uses of Industry

Industrial organizations in common with other segments of Alberta society have found it convenient to control certain biological pests that conflict with industrial activities. Chemical pesticides have been a preferred control method because of the economic advantages of low labour input, low cost and in the case of soil sterilants, lasting effects. Sales figures for pesticides in Canada indicate that industrial use of pesticides is approximately 1% of the total.

The main industrial use of pesticides centres around the employment of herbicides to control vegetation along rights-of-way. Railroad companies practise herbicide spraying along roadbeds to suppress plant growth which may interfere with railway operations. Some cities and towns have in the past assisted the railways by applying herbicides to the railway roadbeds within their boundaries. The aim is for complete removal of brush and weeds and thus the soil sterilant herbicides, such as Picloram, are convenient for this purpose.

More selective, but similarly extensive, are the vegetation control programs along power transmission lines, pipelines and roadways. In forest zones the blanket application of broad leafed herbicides has been undertaken to prevent regrowth of trees which may interfere with powerlines. Along pipeline routes vegetation is suppressed to enable quick access in case of leaks or breakage.

Another large use of herbicides for vegetation control arises from roadside spraying programs. All levels of government have been involved in brush and weed control along roadsides, the primary intent being to eliminate weeds that might spread to farm fields and to control brush hazardous to motoring by obstructing visibility in the summer and creating snowblocks in the winter. Roadside spray programs are reported to be emergency steps prior to the back-sloping and seeding of grass along roadsides.

In the meantime The Alberta Weed Control Act obligates municipalities to destroy all "noxious" weeds growing along roadsides. The most commonly used herbicides for right-of-way control are 2,4-D, MCPA, 2,4,5-T, Mecoprop (MCP) and Picloram. However, the removal of trees and brush from roadsides by application of chemicals can also increase wind and water erosion, destroy habitat for birds and animals, cause snowdrifts to occur and create unsightly prospects that are disagreeable to citizens.* Suggestions had been made that somewhat more comprehensive costing be done to compare chemical control with mechanical control of undesirable right-of-way growths or best combination of the two. An interesting program sponsored by the Neegan Society enables the rehabilitation of people living in areas away from urban centres through their employment in right-of-way maintenance.

Additional problems in right-of-way maintenance, especially when done by the aerial application of a herbicide, arise from the damage done by spray drifting to adjacent fields, trees or households and by the wasting of these herbicides into creeks and lakes where further off-target damage can occur.

Herbicides are also used in the control of weeds around industrial sites. Soil sterilants are used to eliminate weeds around oil and gas storage tanks, buildings and other storage sites for flammable materials in order to eliminate the potential fire hazard afforded by vegetation. Airports have employed herbicides to eliminate weeds from around runway lights, fences and other installations to maintain safe runway conditions. Insecticides are also used to control insects that might attract birds to the airport vicinity causing additional flight hazards through bird strikes. Insecticide use has been reported for control of industrial plant pests. Various types of beetles, weevils, moulds and mites occasionally infest grain storage areas and food processing plants.

* A Staff Report on Snow Accumulation on Rural Roads in Relation to Roadside Vegetation is included herewith as Appendix VI.

Finally, various uses are made of fungicides in industry. Pentachlorophenol, creosote and other wood preservatives are applied to fence posts, railway ties, utility posts and construction timber in industry and as "slimicides" in fuel for jet aircraft. Pentachlorophenol is also used in the manufacture of paper. Industrial activities therefore have a surprisingly high dependence on pesticides for a variety of purposes in Alberta.

RECOMMENDATIONS

- (1) That the need to maintain suitable rights-of-way be supported, but that improved practices to protect off-target areas continue to be developed, including a reduction in the reliance on aerial spraying from aircraft.
- (2) That the use of dormant spray practices for brush control in rights-of-way be encouraged.
- (3) That mechanical clearing of roadside and utilities rights-of-way be undertaken more extensively and that best combinations of mechanical and chemical methods be sought.
- (4) That the program of rehabilitation sponsored by the Neegan Society in which mechanical and manual clearing is done, be encouraged.
- (5) That programs for training aerial spray applicators be continued and even expanded, if required, to meet real needs.
- (6) That aerial applicators require certification by the Department of the Environment and that their training also include a knowledge of pertinent provincial regulations.
- (7) That buffer zones for spraying operations be introduced adjacent to bodies of flowing water, including active road ditches, ponds and lakes. The following buffer distances are recommended:
 - (a) Aerial spray application :
 1. Herbicides - 300 feet
 2. Insecticides - 600 feet (Excepting properly approved mosquito larvicide chemicals)
 - (b) Machine-powered applications :
 1. Herbicides - 100 feet
 2. Insecticides - 200 feet

- (8) That aerial spraying of rights-of-way not be carried out within 3 miles of an urban area nor within 1 mile of a permanent residence, school, hospital or similar institution.
- (9) That roadside areas to be sprayed with pesticides in categories (iii), (iv) and (v) (See section 2.3.4 recommendation 6) be posted prior to pesticide application and the postings maintained for a period of at least two weeks afterwards.

2.7.3 The Manufacture of Pesticides

The needs of the Prairie Provinces for pesticides place emphasis on a relatively small number of synthetic chemicals that can be called critically necessary to the agriculture of the region. These pesticides, like some fertilizers, are made from source materials available from natural gas, oil, coal and salt. Their manufacture in the province could be considered a rational extension of the petro-chemical industry. At the present time most pesticides are made abroad and then only mixed together, dissolved, diluted or "formulated" in Canada. Some small amount of manufacturing has begun. In view, both of the probable difficulties in guaranteeing supplies from outside sources and the natural advantages in using available local raw materials to manufacture chemicals necessary to maintain the agricultural productivity of the region, the extension of the petro-chemical industry in the province to include the synthesis of pesticides most needed in the west would seem sensible, thrifty and prudent.

The manufacture of pesticidal chemicals as well as fertilizers in the province might provide some stability to prices and supply of those commodities in the province.

RECOMMENDATIONS

- (1) That the manufacture of pesticides, important to the west, be encouraged in the province as an extension of the petro-chemical industry here.
- (2) That the protection of supplies of source materials sufficient to meet long-term needs of farmers in Alberta and in Canada for fertilizers and pesticides be accepted as a serious responsibility.
- (3) That policies that provide reasonable stability to the prices and the supplies of pesticides and fertilizers for farmers in the west be encouraged.

2.8 CHEMICALS and FOREST MANAGEMENT



2.8 CHEMICALS AND FOREST MANAGEMENT

Pesticides have not been used to any great extent in forest management practices in Alberta although there have been a series of trial projects on the use of herbicides for thinning lodgepole pine stands and for vegetation control along forestry roads and around forest operation facilities. Insect epidemics have occurred in the past but have largely been confined to the more remote northern regions of Alberta's forests where commercial logging operations have not been undertaken.

Herbicides have been used as a forest management tool, primarily to remove vegetation which competes with commercially valuable tree species for sunlight, moisture and nutrients. In some cases, however, it appears that such problem vegetation may be useful as a soil improver and may in fact contribute to the vigour of the forest. For this reason and because the maximization of timber production is generally in conflict with other forest land uses such as recreation and wildlife habitat, forest managers have been reluctant to utilize pesticides as a safe means of preferred forestry practice.

In the past in Alberta conifer seed has been treated with thiram, aldrin, eldrin and dieldrin for the purpose of repelling rodents but the practice was discontinued.

Forest communities also contain a wide variety of insects which feed on commercially valuable tree species and cause annual losses in the quality and quantity of forest products. The forest industry has generally been tolerant of these losses as long as they remain below an acceptable damage threshold level. Commercial forestry operations may also have influenced the frequency and severity of pest infestations so that, while clear-cutting may remove pest infested timber stands, the practice of seeding or planting cut-over areas to a single tree species may provide ideal conditions for the increase and spread of certain pests. Consequently the proper management of forest practices may reduce the need for chemical pesticides.

Insecticides have been used extensively in eastern Canada to provide easily applicable and inexpensive protection of forests from such pests as the spruce budworm. The many environmental problems that were associated with such pesticide programs are now widely recognized

and there is now hope that the development of biological control methods and improvements in forest management practices, will in the long-term minimize the need for insecticides and other pesticides. In Alberta recent local infestations of spruce budworm have not been managed through the use of insecticides and this decision appears to have been the better course of action. However, as commercial forestry operations expand in Alberta, the need for chemical pest control measures may perhaps be more strongly felt than in the past.

The Authority was informed of the advantages that chemicals can provide in fire protection. The practice does not seem to have permanent environmental impacts and at least, in the context of containing a fire, the practice seems to be establishing itself as a satisfactory and efficient fire control technique. The chemicals act as wetting agents and also assist in the suffocation of the flame.

RECOMMENDATION

- (1) That forest management practice in Alberta continue to de-emphasize the use of pesticides.

2.9 LEGISLATION, REGULATIONS and ENFORCEMENT



2.9 LEGISLATION, REGULATIONS AND ENFORCEMENT

The Federal and Provincial Governments have separate responsibilities but also work cooperatively with each other to legislate, regulate and enforce the ways in which pesticides can be introduced into and used in Canada. The Federal Government controls the movement of pesticides into and out of the country, has primary responsibility for registration and through the National Monitoring Program, has the primary but not exclusive role in measuring the level and incidence of certain pesticides in foods, feeds and soils. The Provincial legislation fulfills responsibilities for pest control under its jurisdiction, supplements Federal pest control legislation and provides for local administration, control, education and enforcement.

Important Federal responsibilities are carried out by the Department of Agriculture, the Department of the Environment and the Department of Health and Welfare. Other departments and agencies, including the National Research Council, provide important support services, act on interdepartmental committees and give advice out of their function or fulfill responsibilities that their departmental jurisdictions require. Before a pesticide can be imported, manufactured or sold in Canada it must first be registered by Agriculture Canada under authority of The Pest Control Products Act.

The registration procedure requires the applicant to submit scientific and technical data which satisfy the criteria according to the Act, including chemical identity, physical and chemical properties, composition of the product, method of analysis, frequency and timing of application of the product, its effectiveness and toxicity to man in various components of the natural environment, residues and recommended use patterns. Other Federal Government agencies concerned with these aspects of registration may also scrutinize the data. The manufacturers' data are then subject to verification by independent university or government scientific appraisal and evaluation prior to registration. Registration can be refused, suspended or cancelled if the product is considered to have failed to meet these various requirements.

The legislation recognizes the changing nature of pesticide research on human and environmental effects and therefore contains provisions for the annual review of registered pesticides. The Act also sets out requirements regarding deception in packaging and advertising, labelling,

safety, manufacture, storage, display, distribution and use. The Act also requires the registration of plants or facilities in which control products are manufactured.

Other Federal legislation controls transportation of dangerous chemicals, the amount of permissible pesticide residue in food products, the compensation to farmers whose products are contaminated with pesticides through no fault of their own, the protection of waters frequented by fish and the application of quarantine techniques to prevent foreign pests or plants from entering the country. The National Monitoring Program begun by the Department of Health and Welfare in 1971 measures the level and incidence of certain pesticides within a given number of major foods. More recently, a new comprehensive Act entitled The Environmental Contaminants Act has at the time of writing just been given third reading. The Authority supports the intent of the new Act which has implications for the use of pesticides, herbicides and related chemicals. Apart from this, many of the recommendations that appear in earlier sections of this report bear upon federal legislation, regulations and enforcement.

In further discussion of legislation, regulations and enforcement, the Authority wishes to direct its attention more specifically to matters for which the Province has responsibility. In the following sections there will be discussion and recommendations on the roles of departments and agencies, the roles of interdepartmental committees, legislation and regulations, the need for enforcement and intergovernmental cooperation.

2.9.1 The Roles of Provincial Departments and Agencies

Within the Province, the Departments of Agriculture, the Environment and Social Services and Community Health have important responsibilities in connection with the use and the effects of the use of pesticides in Alberta. Other departments including Recreation, Parks and Wildlife, Transportation and Energy and Natural Resources also have specific responsibilities or provide advice or information, sometimes through interdepartmental committees on the management and use of pesticides.

The departments have substantial responsibilities. Any new products registered in Canada which may have a use potential in Alberta are evaluated by the Alberta Department of Agriculture for possible recommendation. Such recommendations depend primarily on need for the

product and safety to the applicator and to the environment. Pesticides approved for use in Canada need not be approved for use in Alberta but pesticides cannot be used in Alberta unless they have been approved for use in Canada.

Major provincial legislation will be discussed in more detail in later sections. Many of the problems that they deal with are interrelated. The departments, therefore, have two roles to resolve. There must first of all be clarity as to the responsibilities that a department might have so that regulations and enforcement can follow in a sequential and sensible way. There is also the need for coordination of the work of departments because of the interdependencies of their actions and responsibilities. The end result is a proper protection of productivity within the province together with a proper protection of the human habitat including the health of man and other living species.

A web of interdepartmental committees has been established and has functioned well. These will be discussed in the next section. Some reassignment of roles among the departments has occurred recently in particular the transfer of The Agricultural Chemicals Act to the Department of the Environment. A practical and desirable step and good cooperation through interdepartmental committees seems to have been maintained and even increased, particularly in the Department of Agriculture. Though the Department of the Environment does need some strengthening in this area, there still remains, and will remain a need for expertise in agricultural chemicals within the Department of Agriculture.

The Authority is of the view that the problems of pesticide use need the presentation of highly expert views as well as views of a broader and more comprehensive sort if the important and basic generalities that pesticide use must satisfy are indeed to be reached. There is a need for a sharper input related to human health in many of the decisions taken in respect of the use of these hazardous chemicals. Broad environmental problems are always involved. The Authority is hesitant to recommend extensions of the Public Service. It supports the concept that the Department of the Environment has broad umbrella-like coordinative responsibilities and needs the staff to bring about the coordinations. It also supports the principle that the departments with statutory responsibilities for the health of man and other living species and for productivity of fields and forests retain the expertise needed to fulfill their roles and make this expertise available to the coordinative mechanisms government needs to reach and maintain balanced objectives.

RECOMMENDATIONS

- (1) That the Department of the Environment retain and develop further its responsibilities for coordinating and maintaining a general overall responsibility for environmental protection in respect of the use of hazardous chemicals and that it be provided with the staff necessary for this task.
- (2) That the departments with statutory responsibilities for the health of man and other living species, particularly the Departments of Agriculture, of Social Services and Community Health, of Energy and Natural Resources and of Recreation, Parks and Wildlife maintain, and as necessary improve upon, their effectiveness in fulfilling these responsibilities. The Departments should maintain and provide expertise for their own functions and for the coordinative mechanisms and interdepartmental committees, including those under the auspices of the Department of the Environment that are necessary to achieve balanced objectives.
- (3) That in respect of The Agricultural Chemicals Act, a review of personnel be undertaken by the Department of the Environment and the Department of Agriculture to judge when staff should be transferred and when new staff should be sought so that each department can best fulfill its separate and joint responsibilities.

2.9.2 The Role of Interdepartmental Committees

The multiplicity of uses to which pesticides are put involves the interests of several departments of government. Agriculture, Environment, Energy and Natural Resources and Transportation all have interests in uses and applications of pesticides. Within a particular department such as Agriculture, there is a great diversity of uses dependent upon various farming operations, local conditions and areas of infestation of the various pests. The degree of specialization required for best use dictates that the use and control of the broad spectrum of pesticides also requires specialization at the professional level. The whole subject area of pesticide use has many variables and conflicts associated with it so that it is quite natural to expect that committee structures are best able to evaluate such problems. Within such committee structures, coordinative mechanisms are vital instruments.

2.9.2.1 Committees within the Department of Agriculture

In Alberta, the committee structure within the Department of Agriculture is well developed and coordinated under the Alberta Agricultural Co-ordinating Committee. The advisory committees which report to the Co-ordinating Committee number fourteen and deal with many facets of agricultural activity including the use of agricultural chemicals. The committees have representation from government, research stations, universities, other educational institutions and from industry. The committees are listed below:

1. Alberta Veterinary Medicine Advisory Committee
2. Alberta Weed Advisory Committee
3. Alberta Horticultural Advisory Committee
4. Alberta Cereal and Oil Seed Advisory Committee
5. Alberta Pest Control Advisory Committee
6. Alberta Soils Advisory Committee
7. Alberta Forage Advisory Committee
8. Alberta Agricultural Economics Advisory Committee
9. Alberta Agricultural Engineering Advisory Committee
10. Alberta Dairy Advisory Committee
11. Alberta Animal Nutrition Advisory Committee
12. Alberta Animal Breeding Advisory Committee
13. Alberta Agricultural Education and Role Extension Advisory Committee
14. Alberta Food Processing Industry Council

The above structures have been well thought out and the Department of Agriculture is to be complimented for its thoroughness in developing its committee structures and its coordinative mechanisms.

2.9.2.2 Interdepartmental Committees

In addition to the committees which operate under the coordinative mechanisms of the Alberta Agricultural Co-ordinating Committee, there are eleven other committees which deal with specific problems or areas of interest. This group of committees and their essential functions and membership are listed below:

1. The Alberta Interdepartmental Committee on Pesticides.

This Committee has access to the Ministers of Agriculture, Environment, Social Services and Community Health, and Parks, Recreation and Wildlife. The Committee meets as often as it feels necessary and is normally looked upon as the action committee because of its access to these Ministers.

2. Black Fly Co-ordinating Committee.

This Committee is composed of representatives of both federal and provincial departments of Agriculture and Environment, and the federal Department of Fisheries; it also has membership from elected representatives.

3. The Western Committee on Livestock Pesticides.

The Committee is composed of representatives from the four western provinces, from industry and also from the federal government and meets annually.

4. Wildlife Predator and Conservation Committee.

This Committee is chaired by the Chief Wildlife Biologist of the Alberta Fish and Wildlife Division, while the other members are from the Department of Agriculture. The Committee meets as required.

5. The Canada Committee on Pesticide Use and Agriculture.

This is a federal Committee which meets about twice a year and has provincial representation.

6. The Canada Weed Committee, Western Division.

This Committee is composed of representatives from the four western provinces. Membership is quite broad and includes representatives of the Federal Government and the northern states of U.S.A.

7. The Western Committee on Crop Pesticides.

This Committee is composed of membership from the four western provinces, the Federal Government and also includes some American representation.

8. The Alberta Department of Agriculture Food Residue Committee.

This Committee meets once or twice a year, or whenever necessary and is composed of representatives from various agencies and government departments within Alberta.

9. The Aquatic Plant Control Committee.

This Committee is structured under the Dept. of the Environment, meets once or twice annually and handles all pesticide problems related to the growth of aquatic plants.

10. The Agricultural Chemicals Advisory Committee.

This Committee reports directly to the Department of the Environment and its membership consists of representatives of the Department of Environment, Department of Agriculture, the Department of Social Services

and Community Health, Department of Recreation, Parks and Wildlife, Department of Business Development and Tourism and also the Association of Municipal Districts and Counties.

11. The Warble Fly Control Committee.

This Committee answers to the Department of Agriculture and has representation from the Departments of Agriculture and Environment and also from the municipalities.

The interdepartmental committees have in many cases provided invaluable services to the province. The Alberta Interdepartmental Committee on Pesticides whose work was so helpful to the Authority in its public hearings on the use of pesticides in Alberta has membership from outside government as well as within it. The Committee has, in this way, attempted to gain access to the full range of views that relate to its activities. This has been most helpful in developing and updating its functions.

The Authority commends the committees for their good work and supports the concept of non-governmental membership as a source of additional points of view to broaden and bring balance to the work of the committees.

The coordination of the activities of these interdepartmental committees is a little more tenuous and is achieved mostly through cross committee memberships. However, there is no umbrella committee which can provide a medium through which the activities of the several committees are brought together and coordinated. A move towards such more formal coordination would be helpful.

RECOMMENDATIONS

- (1) That the interdepartmental committees be commended for their good work and encouragement be given to them in its continuance.
- (2) That the principle of membership from outside government to fill out and broaden the view of the interdepartmental committees be accepted as a way of gaining broader input and achieving balanced objectives.
- (3) That a central coordinating committee be structured under the Pesticide Chemicals Branch of the Department of the Environment to bring about a close and more formal liaison with all committees particularly interdepartmental committees which deal with pesticides used within Alberta.

- (4) That this committee be based upon the Agricultural Chemicals Advisory Committee adding the coordinating functions to its present responsibilities, with additional membership as required and that all of the last named eleven committees and the Alberta Agricultural Co-ordinating Committee have membership on the new committee. (See also recommendation 1 under section 2.9.3.1.1.)
- (5) That one of the tasks of the expanded Co-ordinating Committee be to carry out a continuing review of the terms of reference for each committee and the need for its continuance in the provincial scene.
- (6) That the expanded Agricultural Chemicals Advisory Committee, when expanded and renamed, continue to report to the Minister of the Environment through the Pesticides Chemicals Branch.

2.9.3 Legislation and Regulations

The control of the use and application of pesticides within the province rests within the provisions of twelve Provincial Acts some of which have direct application while the remainder are indirect. A number of these Acts have been or are currently in the process of change or amendment which reflects the increasing recognition of the role of pesticides in the environmental mosaic. These Acts are briefly reviewed to give them identification and to enumerate those areas of legislation which the Authority feel are deficient. A more detailed review of the pertinent Federal and Alberta Acts is presented in a separate publication now being prepared by the Authority.

2.9.3.1 The Agricultural Chemicals Act

This Act provides for the creation of an Agricultural Chemicals Advisory Committee, specifies the use and the limitations on the use of agricultural chemicals, prescribes labelling and also provides for the destruction of chemically contaminated food or feeds without compensation. Regulations for storage, transportation, protection of water bodies, disposal, restricted or prohibited chemicals, the use of pesticides in research, and the general use, application, and who may apply chemicals, are provided for. In general, the provisions of the Act are very good but fall short in some areas. It should be kept in mind that this Act is under review at the present time and is scheduled for amendment in the near future.

The Agricultural Chemicals Act is administered and enforced by the Pesticide Chemicals Branch of the Department of the Environment. It is appropriate to suggest that the scope of the Agricultural Chemicals Act be broadened and renamed, so as to include all pesticide chemicals used in the province, whether in agricultural, urban or forest settings. The new Act could well be called The Pesticide Chemicals Act. There are some reasons to broaden the Act still further so as to include all hazardous chemicals. The Authority will not go so far as to recommend this further enlargement but wishes to draw attention to it, with the intention that further consideration be given to it.

Previous recommendations have been made that would substantially enlarge the responsibilities of the Pesticide Chemicals Branch. These included licensing of outlets and of pesticides applicators and the establishment of prescription processes in the sales of the pesticides. The recommendation has also been made that a renamed and expanded Agricultural Chemicals Advisory Committee should act as a general coordinating committee for all interdepartmental committees with responsibilities that reflect, directly or indirectly, on the control of populations of living species or through the use of pesticides affect the health of man or the productivity of his crops. Membership from each interdepartmental committee, through its Chairman, or an alternate, is suggested. The new coordinating committee derived from the Agricultural Chemicals Advisory Committee, could reasonably be renamed the Pesticides Chemicals Advisory Committee, to reflect its enlarged responsibilities, and be attached to the Pesticides Chemicals Branch, who would provide the secretariat and the coordinating impulse to the Committee's work.

It is important that the amendments to The Agricultural Chemicals Act, the enhanced responsibilities of the Pesticides Chemicals Branch and the important coordinative function of the new advisory committee all be so written and established as to bring a balanced point of view to bear on the use of pesticides in Alberta. This is needed so that both the benefits of the use of these chemicals, the hazards that can arise from their use and the development of integrated chemical and non-chemical systems are constantly under review and the objective of most beneficial use is seen in the broadest light and is approached in a systematic, comprehensive and prudent way. Some minor more specific matters also merit comment.

2.9.3.1.1 Specific Measures Under The Agricultural Chemicals Act.

Pesticide spray vehicles are often seen on public roads carrying out their assigned tasks of weed or brush control. However, these vehicles are often not identified as to their task or what chemical is being applied. There is cause for alarm in some areas because chemicals may be used which present a hazard to livestock or cultivated vegetation. Prominently located signs identifying the task of the vehicle and the chemicals being dispensed would be most helpful to adjacent landowners, would help in the education of the public and would suggest to applicators that they are under the public's observation and thus encourage a more skilful application. When damage is done to non-target species, the offending chemical is more quickly identified. This Act also provides for daily inspection by a licensed applicator of those employees who work in chemical application under his supervision. Enforcement of this provision could be more successful under the watchful eye of the public.

The Authority has noted that the application of chemicals in the green zone rights-of-way is virtually uncontrolled. There is need to have a regulation governing the application of agricultural chemicals in these areas.

The regulation of sales of agricultural chemicals should be more rigid and based upon the qualifications of each vendor to dispense chemicals in a series of classifications related to their toxic content, non-target implications and persistence in the environment. Chemicals that are identified as dangerous for any reason should be identified so that complete records are maintained as to the identification of the purchaser, the amounts sold and location of applications. Such records should be regularly submitted to the Pesticide Chemicals Branch of the Department of Environment and stored in a suitable manner so that subsequent possible adverse effects can be related to the chemical used.

It is also noted that open ponds and bodies of water completely surrounded by private property are exempt from control. Many of these bodies of water provide suitable and necessary habitat for a large variety of wildlife which are in fact the property of the Crown. The use of chemicals in a manner that could jeopardize the existence of such wildlife should be regulated to ensure the continued existence of our rich and diverse biotic community.

Next, the greenhouse operator is not adequately covered under the provisions of the Act. Because the operator of a greenhouse presents a special case in agricultural chemical use, special regulations are required for this type of operations. (See section 2.7.1.)

Under the provisions of The Agricultural Chemicals Act, the administration and enforcement of the Act and its regulations at the user level are the responsibility of the municipality. The role of enforcement or inspection is usually a task assigned to the agricultural fieldmen in the municipality. This brings about an interesting situation in that the agricultural fieldmen have duties which may conflict with their role as inspector in relation to the provisions of The Agricultural Chemicals Act. In most municipalities the agricultural fieldmen also carry the responsibility for weed control on municipal rights-of-way. As a result the fieldmen are both large users of agricultural chemicals and, at the same time, inspectors of such use.

Under these circumstance, and because of the general responsibilities of the Pesticides Chemicals Branch, it would seem logical to suggest that the pesticide related functions of the District Agriculturalist be subject to inspection by the Pesticides Chemicals Branch. This would tend to limit conflict situations for the District Agriculturalist whose work is so important to the province.

RECOMMENDATIONS

- (1) That The Agricultural Chemicals Act be amended so as to include jurisdiction on all pesticides and be renamed The Pesticide Chemicals Act to reflect this broader jurisdiction.
- (2) That in the revised Act additional regulatory responsibilities be assigned the Pesticides Chemicals Branch, including licensing and inspection of applicators and outlets, surveillance of prescriptive processes for pesticides and other tasks as outlined in earlier recommendations.
- (3) That the Agricultural Chemicals Advisory Committee be renamed the Pesticides Chemicals Advisory Committee and be given membership from each of the interdepartmental committees previously referred to and assume the additional role of coordinator to these interdepartmental committees.

- (4) That the Pesticide Chemicals Branch provide the secretariat to the Pesticides Chemicals Advisory Committee and together be charged with the responsibility of bringing a balanced view to bear on the use of pesticides in Alberta as described in greater detail in the text.
- (5) That specific tasks suggested for the Pesticides Chemicals Branch include the following:
 - a. To require that spray vehicles treating municipal rights-of-way carry large signs at both front and rear that identify the task of the vehicle, the chemical used and the name of the municipality or the commercial sprayer.
 - b. To require that a special provincial permit be required of anyone spraying in the green zone.
 - c. To establish that the vending of any chemical be controlled by a classification of chemicals related to the danger and the capability of the vendor to suggest or prescribe their use (see also section 2.3.4 recommendations 6-12).
 - d. To keep a record of all dangerous chemicals sold with regard to purchaser, amounts and locations of applications (See also section 2.3.4 recommendations 13-15).
 - e. To receive all records of sales of dangerous agricultural chemicals for storage and later use in evaluating the long-term effects of such chemicals (See also section 2.5.5 recommendation 1.)
 - f. To prescribe regulations that protect lakes and ponds surrounded by private property so as to prevent unnecessary hazard to wildlife.

2.9.3.2 The Agricultural Pests Act

This Act was proclaimed in 1974 and replaces the old Agricultural Pest Act and the Setting of Poisons Act. It allows for the naming of plant and animal pest and provides for the landowners to take action against such pests. A provision is also made for the regulations to enable the appointment of Pest Control Officers who can stipulate the measures which must be taken to specify control mechanisms for coyotes, magpies, rats, bacterial ringrot, skunks and warble flies as well as other pests and nuisances.

It is noted that in the regulations concerning devices for coyote control the chemical agent compound 1080 is treated as a more dangerous chemical than strychnine or cyanide. Such strict regulations should be applied to any chemical whose toxicity is high. There should also be a record of the location of highly toxic baits so the public may be informed of such locations.

Under magpie control, the use of strychnine is allowed. The use of strychnine baits for magpies presents a serious hazard to a broad spectrum of birdlife most of which are quite beneficial.

RECOMMENDATIONS

- (1) That strychnine and cyanide be recognized as highly toxic and dangerous chemicals and that regulations require them to be used with the precautions accompanying that category of pesticides.
- (2) That the location of baits containing toxic or dangerous chemicals should be posted for public information.
- (3) That since the danger magpies presents to man seems to be overrated, the control of these birds by toxic chemicals be reviewed.

2.9.3.3 The Weed Control Act

This Act came into effect in January 1973 and addressed itself to the control of undesirable vegetation. The Act provides for the naming of noxious weeds and the accepted methods of control. A provision is also made for the municipalities to name noxious weeds, with the approval of the Minister. The most significant aspect of the Act is the provision for the inspection of lands without warrant for the presence of noxious weeds or seeds and the destruction of such weeds or seeds. The appointment of Weed Inspectors in the municipality is provided for in the Act and powers are granted to such inspectors to order the destruction of noxious weeds or to destroy them at the expense of the landowners.

Weed control on rights-of-way is usually carried out under the provisions of this Act. There are some problems associated with such spraying activity since the chemicals used are usually lethal to all

broad leafed plants with the result that the brush and sometimes valuable plants are also eradicated. (Pertinent recommendations have appeared in other sections e.g. 2.5.3.2 and 2.5.3.2.1.)

2.9.3.4 Other Legislation

The Wildlife Act provides regulations pertaining to the control of wildlife and restrictions upon the destruction or disturbance of certain species. Wildlife Officers are authorized to destroy or remove any animal which is destructive to private property. Under the provisions of The Pharmaceuticals Act, the poison register is maintained purely to record sales of toxic chemicals for use in the home and urban areas. Much pesticide activity is carried out by the municipalities and in The Municipal Government Act, there is legislation which provides for such activity. Under The Public Health Act, the use of hydrocyanic acid as a fumigant is regulated and provision is also made for the determination of the maximum levels of contaminants in both air and water. The Clean Water and Clean Air Acts contain the regulations which provide for the enforcement of the levels specified by The Public Health Act.

The Department of the Environment Act provides for the coordinative mechanism which oversees the general application of all Acts which concern the preservation of environmental integrity. Within the Act too, are powers to control the manufacture and sale of any substance within the province. The Agricultural Service Board Act enables municipalities to appoint officers who may act under the provisions of one or more of the Acts which pertain to pest control. Finally, regulations for the control of pesticides in the forest area are covered under legislation governing pesticide use in forests and along rights-of-way.

In the past there has been some tendency on some occasions to let enforcement go since many thought the dangers and hazards of pesticide use could be ignored. As experience has shown the risks and dangers of improper use of these chemicals have become well known and the hazards that can arise even from cautious use are not without significance. The trend everywhere has been towards more prudent practice, stricter regulations and more rigorous enforcement of the regulations. These trends seem appropriate for Alberta as well.

RECOMMENDATION

- (1) That the trend towards more prudent use of pesticides, stricter regulations and more rigorous enforcement of the regulations be accepted and adopted by Alberta.

2.9.4 Intergovernmental Cooperation

The use of pesticides is worldwide and the results of such use are made complex because of the many ways in which such chemicals may be distributed throughout the globe. Movement of chemicals or their residues is an ongoing process due to the action of rainfall on soils, the flows along rivers and streams and subsequently by the giant ocean currents. Other residues are carried by air currents which know no international boundaries. Wildlife itself, because of its migratory activity, carries varying amounts of chemicals into and out of various eco-systems and thereby makes some form of contribution to the contamination of the local food chain and the greater concentration of contaminant chemicals.

Nature has never recognized the sovereignty of individual nations and thus, whether man approves or not, individual national uses of chemicals are of concern to all of the world's people and to all living species. In recognition of this problem, the United Nations at an early date addressed itself to some of the problems related to agricultural chemical contamination of the globe. Since that time, a series of international committees have worked on a multiplicity of facets of the general problem. International organizations are to be commended for their efforts and for their successes in the past. Much new knowledge and information has been brought to the public attention through this work.

The problem which man faces in the management of the biosphere includes the largest part of the Earth's surface, namely the oceans, over which no nation holds uncontested domain. Yet this gigantic portion of the biosphere is vital to the survival of most living species. The use of a dangerous chemical in one nation could have worldwide impact on oceanic life often far from the source of the contaminant. Clearly, international cooperation coupled with national restraints are vital if a reasonably balanced global eco-system is to be sustained.

On the same basis even small nations, because of differing regional requirements, face the problem of all of the people being chemical recipients while only a small segment are major contributors. Within our own national boundaries the variability of agro-chemical use is as diverse as the landscape, the soil types and the climate. The problem of scale is clearly evident even at the provincial level where these same variables cause differing uses of agricultural chemicals in different regions.

Cooperative effort at the federal / provincial level had been addressed to the task of proving efficacy, checking for off-target effects and identifying any other deleterious results of such chemical use on any part of the biosphere. There is another component of intergovernment cooperation which may not have been the recipient of the full benefits which could derive from cooperation and that is the problem of chemical supplies. The world food problem is indeed a problem of the world and therefore the distribution of important components of food production such as agro-chemicals should merit attention at the international level. To achieve this, the major food producers of the world must have at hand the agricultural chemicals which are a necessary part of the success of their own agricultural operations.

RECOMMENDATIONS

- (1) That the existing intergovernmental cooperation in pesticide use be recognized for its important contribution.
- (2) That the provincial government become active in seeking representation on international committees which address themselves to the use of pesticides.
- (3) That intergovernmental committees direct themselves to the task of reviewing the sources of supply of needed agro-chemical products and the assurance of continued supplies.
- (4) That existing intergovernmental committees continue to receive provincial support and that the work of these committees be updated where needed.

The Authority wishes respectfully, to place these recommendations before you.

ENVIRONMENT CONSERVATION AUTHORITY

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DR. W. R. TROST CHAIRMAN

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J. J. KINSKY, VICE-CHAIRMAN

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M. NOBLE, MEMBER

APPENDIX I

PUBLIC INFORMATION AND PARTICIPATION



PUBLIC INFORMATION AND PARTICIPATION

The Authority always endeavours to ensure that good, reliable information on all sides of the subject under enquiry has been presented to the public, well in advance of the public hearings. The use of the technical sessions on which to base public documents for the hearings represented a novel and valuable approach in the preparation of pre-hearing information. Data obtained from the technical sessions was documented by a consultant hired by the Authority to work for the Science Advisory Committee. The results were presented in the form of a five-part document entitled *Biocide Use in Alberta*. These five sections were printed by the Authority as Information Bulletins Nos. 3 to 7 and were released prior to the public hearings as technical background information. It was, however, clear that additional bulletins were needed to put all the relevant information before the public.

1. THE INFORMATION CENTRES

The Authority has developed and maintains a chain of information centres in selected public, municipal and institutional libraries as well as town, municipal and regional planning commission offices throughout the province.

The information bulletins were given wide public distribution through selected mailings, at a series of preliminary information meetings and were placed in 53 Information Centres established by the Authority across the province. Information Bulletins Nos. 1 and 2 entitled *Terms of Reference and Prospectus for the Public Hearings*, respectively, described the nature of the hearings and summarized the risks and benefits of pesticide use in a general way. Information Bulletins Nos. 3 to 7 prepared by the Science Advisory Committee under the general title, *Biocide Use in Alberta* dealt with regulations, herbicides, insecticides, fungicides and vertebrate poisons. Information Bulletin No. 8 entitled, *The Effects of Pesticide Use on Productivity and Health in Alberta*, provided additional insight into the primary or beneficial effects of the use of chemical pest control products and made evident the reasons why such products have come into use.

The Information Centres normally provide a repository for the Authority's publications within reasonable access to most residents. By visiting an information centre any citizen may freely examine and make

use of these materials or, if they wish, obtain copies of them by request to the Authority's office in Edmonton. With the exception of the *Proceedings of the Public Hearings* for which a nominal charge is made, all Authority publications are free.

Because of widespread rural interest in the public hearings on the use of pesticides and herbicides, the Authority decided to extend its system of information centres to a number of rural centres which had not previously been served. In all, twelve new information centres were established in the towns of Brooks, Cardston, Coronation, Lloydminster, Medicine Hat, Olds, Stettler, St. Paul, Vegreville, Vermilion, Wainwright and Westlock. These served the additional purpose of providing a further means of informing local residents of the impending hearings as well as the times and places of the pre-hearing meetings which the Authority in association with Unifarm was conducting across the province.

Following the public hearings, the Authority commissioned a survey of its information centres in order to assess their suitability, accessibility and the extent of their use by local residents. The survey indicated that in general, steady use was being made of the information centres and those who operated them considered them worthwhile. The centres located in urban areas, particularly those associated with a college or university, tended to have more than average use while those in rural localities were used mainly when a public hearing was coming along.

2. PUBLIC INFORMATION MEETINGS

During June and July 1974, after spring work on the farms was over, a series of public information meetings were held in eighteen centres throughout the province. The public meetings were held several months before the hearings opened so as to give everyone an opportunity to prepare themselves well in advance. Unifarm was most helpful both in an advisory and in an active role in organizing the public information meetings and in suggesting locations at which they should be held. Public meetings were held at Medicine Hat, Lethbridge, Airdrie, Hanna, Drumheller, Stettler, Edmonton, Bawlf, Wainwright, Red Deer, Vegreville, Westlock, Grande Prairie, Lac La Biche, St. Paul, Falher, Fairview and Manning. These locations are shown on the map on Page 125. The public meetings, once set up, were made more useful through the cooperation of

Agricultural Fieldmen and District Agriculturists of the Alberta Department of Agriculture. The organizational network and the familiarity with agricultural practices of Unifarm, a province-wide organization, was helpful throughout. The objectives of the meetings were to inform rural and urban users of pesticides as to the nature of the public hearings, the topics likely to arise during the hearings and the mechanisms involved in the public hearing process. They also served as a valuable vehicle to give widespread distribution of the Information Bulletins and gained great advantage from the exchange of views and experience among the members of the community.

3. PUBLIC NOTICES

The public hearings were publicized by means of newspaper advertisements as well as radio announcements throughout Alberta. The initial announcement of the hearings was made in the spring of 1974 when a news release was issued to the press by the Minister of the Environment. This was followed in July the same year by a news release from the Authority when the locations for the hearings were announced. The advertising program consisted of a series of three insertions of a substantial advertisement in each of seven daily and seven weekly newspapers, supplemented by radio spot announcements timed to coincide with the hearing in the particular locality served by the station. The locations of the newspaper and radio outlets are shown in the map on page 125.

To publicize the pre-hearing meetings, posters were prepared by the Authority and distributed through the good auspices of Unifarm and the District Agriculturists in the various locations for meetings and hearings. These people also helped enormously by word of mouth promotion in the field, to encourage interest and participation in the pre-hearing meetings and the hearings that followed.

4. THE PUBLIC HEARINGS

The public hearings were held in two steps. The main body of hearings took place in fourteen Alberta centres during the period of October 28 to November 28, 1974. The fourteen locations represented the outcome of a formal and objective method of selection which ranked the possible locations according to the strength with which they reflected

pesticide user activities and the influence of these locations upon the surrounding area. The centres used as hearing locations were considered to adequately represent the major agricultural and urban users and to provide geographic accessibility to the hearings for all Albertans who had an interest in the issues at hand. The hearings began in Edmonton and then followed a general south-to-north progression through Lethbridge, Medicine Hat, Calgary, Drumheller, Three Hills, Red Deer, Stettler, Camrose, Wainwright, Vermilion, Westlock, Peace River and Grande Prairie. The principal objective of these hearings was to get as much advice and information as possible from the people in the province who use or are directly affected by pesticides and herbicides.

The second step of the process was to hold a series of supplementary hearings to allow submissions of a more technical nature as well as additional submissions on various aspects of pesticide use. These hearings held one day a week for 11 weeks were heard in Edmonton and once in Brooks. The final hearing, which emphasized the effects of pesticides on bird populations, was concluded in mid-April of 1975. The supplementary hearings were valuable in not only allowing for additional submissions but also served to enhance constructive debate of many of the controversial issues and disparate points of view surrounding the use of pesticides and herbicides in the province. A total of 196 briefs were received in connection with the hearings.

5. SUMMATION AND REPORTING

All submissions received by the Authority as well as the transcripts of the public hearings have been published as a series of seven volumes entitled *Proceedings of the Public Hearings*. The Proceedings are divided by location of the hearings, as follows:

- Volume I - Edmonton, Lethbridge, Medicine Hat
- Volume II - Calgary, Drumheller, Three Hills
- Volume III - Red Deer, Stettler, Camrose, Wainwright
- Volume IV - Vermilion, Westlock, Peace River, Grande Prairie
- Volume V - Supplementary Hearings at Edmonton and Brooks, January 21 to February 18, 1975
- Volume VI - Supplementary Hearings at Edmonton, February 25 to April 17, 1975. Also includes written submissions.

Volume VII consists of an index to all the submissions made to the Authority during its public hearings.

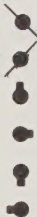
Copies of these proceedings may be obtained from the Queen's Printer of Alberta at a nominal cost of \$4.00 per volume or \$24.00 per set.

The overall evaluation by the Authority of the subject is represented in its Report and Recommendations on the Use of Pesticides and Herbicides in Alberta.

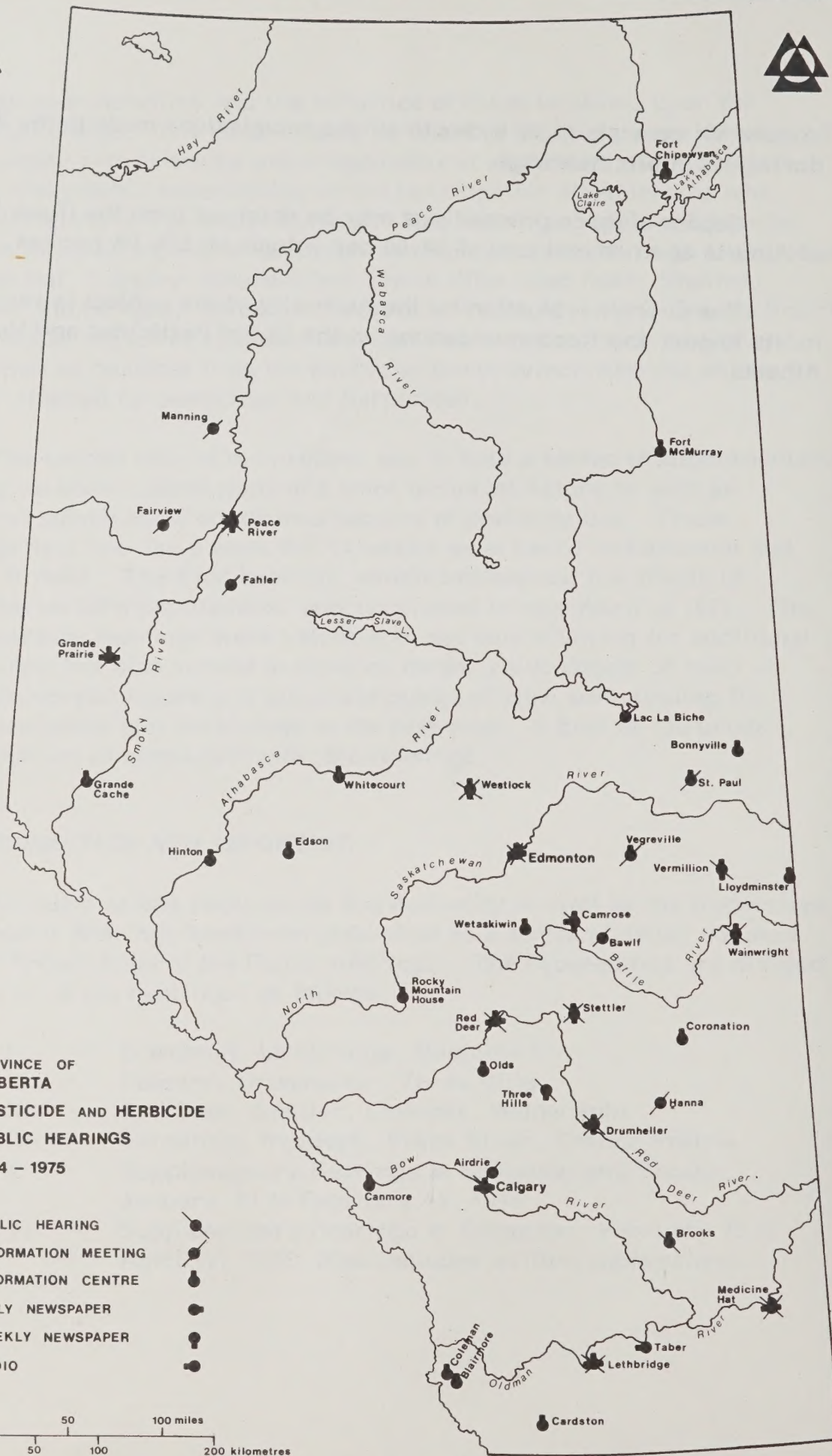


PROVINCE OF
ALBERTA
PESTICIDE AND HERBICIDE
PUBLIC HEARINGS
1974 - 1975

PUBLIC HEARING
INFORMATION MEETING
INFORMATION CENTRE
DAILY NEWSPAPER
WEEKLY NEWSPAPER
RADIO



0 50 100 miles
0 50 100 200 kilometres



APPENDIX II

SUMMARY OF THE HEARINGS



1. OVERVIEW OF THE HEARINGS

The public hearings into the Use of Pesticides and Herbicides in Alberta attracted a wide range of submissions and representations from people in all walks of life and from them the Authority received valuable information and comment on all major aspects of pesticide use in Alberta, in Canada and the world in general.

Submissions ranged from the initial research and development of new pesticide chemicals through the various phases of their assessment for efficacy, safety and commercial acceptability to the various processes and procedures involved in obtaining registration and government approval for use. Some went further to comment, sometimes in strong terms, on the need for re-evaluation and re-registration at various time intervals.

Although most individuals who participated related to pesticides in more than one way, the submissions, nonetheless, tended to present the dominant points of view of three main categories of the public, namely, the industrial group who are the producers and purveyors of pesticides, the regulatory and advisory agencies, and the general public who are the user group.

The response of each major sector as assessed by the number of briefs presented is shown in Table 1. This shows that the response of the general "user" public as well as the advisory and regulatory agencies was strong and sustained throughout both the initial and the supplementary hearings. The industrial or producer group on the other hand after an initial involvement in the very early sessions, was very active in its participation in the supplementary hearings. At these sessions, however, their participation was very intensive and in most cases very technical in nature. The Authority was presented during these latter sessions with a large and wide variety of technical papers, brochures, monographs and advertising literature on a number of proprietary pesticides. These were valuable not only for the information they contained on properties and precautions for use but also for such additional information as labelling and package sizing as well as concentrations and formulations for different applications.

1.1 Response of the General Public

A variety of individual and organization interests were represented at the public hearings. Many of the citizens who participated were

farmers and agricultural people with first-hand knowledge and experience in matters related to pesticide use in agriculture. Other individuals spoke from the viewpoint of urban users of pesticides. Students presented their concerns about the quality and preservation of the natural environment, and professional people from the universities, schools and research institutions with expertise in special aspects of pesticide use (including chemical properties, environmental and human health hazards, and the characteristics of pest organisms, etc.) also contributed freely.

The Authority heard from such varied organizations as schools, environmental groups, parks and recreation groups, natural history clubs, consumer organizations, farm groups and professional societies, all of whom presented opinions ranging from the ideal to the practical, and in spirits ranging from unlimited optimism to deep gloom. Many of the views presented were diametrically opposite; all, however, contributed to the body of information required by the Authority as a resource base for its final report.

As shown in Table 1, the contribution of the general public was consistent throughout the hearings. Public input was greatest in those larger centres which served as a focal point for a surrounding productive agricultural region and which were close to agricultural research stations. The smaller urban centres generally provide a lower number of inputs despite large agricultural hinterlands. The views presented by all segments of the public were invaluable in identifying controversies, problems and points of agreement concerning pesticide use in Alberta.

1.2 Response of Regulatory and Advisory Agencies

Officials of towns, cities, counties and improvement districts all contributed to the discussions of pesticide use as it applied to local laws and regulations, practices and programs. The representations came from such groups as city health units, parks and recreation departments, agricultural service boards and committees, environmental control officers along with government officials, and provincial personnel acting as resource support to local agencies provided a great deal of insight into the current regulations and practices regarding pesticide use. Some of these submissions showed the advantages gained from pesticide use in roadside brush control and weed control, and rabid animals and other pests. Criticisms of some of the comments made by the Science Advisory Committee in Bulletins Nos. 3 to 7 were placed before the hearings

especially of the Committee's view on practices related to herbicide use. There was also a general emphasis on the need for better public education, improved practices and more awareness of the risks in pesticide use. The Alberta Department of Agriculture provided a written situation statement and was helpful in many aspects of the pre-hearing preparations.

Federal government input was also made at the hearings, coming primarily in the form of submissions from government research groups associated with pesticide control, use and evaluation. Environment Canada, Agriculture Canada and the National Research Council all made submissions. A review and elaboration of the research methods in use, the techniques of the potential for the adoption of biological control methods and the hazards presented by pesticides to non-target species provided the major emphasis in the submissions of such agencies.

1.3 Response of Industry

The third major origin of submissions to the Authority consisted of the pesticides manufacturing and marketing companies along with associated businesses directly involved with pesticide products.

Industries and businesses connected with pesticides tended to defend the use of pesticides in modern society and underscored the benefits that have accrued because of their availability. They also provided much information regarding the development of individual products, their chemical nature and properties, their environmental impacts and their effect on living species. Industry often stressed the difficulties and expense of developing new pesticide products with today's high costs and detailed registration requirements. The importance of providing better education in the use of pesticides, proper training of applicators and the design and content of pesticide labelling were also emphasized. The inputs of this group represented valuable assets to the Authority's deliberations on pesticide use especially with regard to research and development, testing, marketing and the economics of providing chemical pest control products.

1.4 Resolution of Opinions

The Public Hearings into Pesticide and Herbicide Use in Alberta were not without some controversy, a fact that helped to generate good discussion. A stimulus to much of the debate which occurred at the hearings was the series of Information Bulletins prepared on behalf of

the Authority by its Science Advisory Committee. The Bulletins on Biocide Use in Alberta, Nos. 3 to 7, contained a great deal of concern and criticism in their evaluation of the past and present situation related to pesticide legislation, regulations and use practices. While the Bulletins were written in a responsible and constructive vein, many participants at the hearings felt a need to comment upon and even attempt to refute some of the comments made in these bulletins. Bulletins Nos. 1, 2 and particularly No. 8 placed greater emphasis on the benefits pesticide use had provided to productivity and human health. These bulletins were also subject to criticism. As a result of these debates, the Authority was able to obtain a clear view of the status of pesticide use in Alberta and of the weaknesses and strengths of the legislation and regulatory practices that control it.

During the initial sessions the controversies raised by the bulletins sometimes assumed a position of dominance over other discussion. While certain basic beliefs could not be compromised, it became evident in the more technical supplementary sessions that the separate views were not as far apart as they appeared to have been. A special in-camera meeting of representatives of the scientific community took place in the offices of the Authority on March 25, 1975. Some differences in opinion could not be resolved such as the allowable degree of environmental risk related to pesticide use and the definition of what constitutes disruption in an ecosystem. However, it was possible to establish an atmosphere of reconciliation in which the basic points of contention could be identified and in which ways of solving the problems could be discussed. The Authority was pleased with the outcome of the meeting for it not only provided insight into the most acceptable means of accomplishing a balance between productivity and protection but also indicated that a continued divergency of views on pesticide use would probably ensure the constant surveillance and re-evaluation that is vital to the protection of the natural environment on which man ultimately depends.

TABLE 1
ORIGIN OF BRIEFS SUBMITTED
TO PUBLIC HEARINGS ON PESTICIDE AND HERBICIDE USE IN ALBERTA

<u>HEARING</u>	<u>ORIGIN</u>		
	<u>Industry</u>	<u>Regulatory and Advisory Agencies</u>	<u>General Public</u>
<u>A. MAJOR SESSIONS (1974)</u>			
EDMONTON	2	1	8
LETHBRIDGE	0	6	11
MEDICINE HAT	2	2	4
CALGARY	2	4	5
DRUMHELLER	1	1	1
THREE HILLS	0	2	3
RED DEER	2	2	11
STETTLE	1	0	7
CAMROSE	0	1	6
WESTLOCK	0	3	3
VERMILION	0	0	3
WAINWRIGHT	0	1	3
PEACE RIVER	0	3	9
GRANDE PRAIRIE	1	1	3
<u>B. SUPPLEMENTARY SESSIONS (1975)</u>			
EDMONTON (JANUARY)	4	0	6
BROOKS (FEBRUARY 4)	1	1	3
EDMONTON (FEBRUARY)	2	5	9
EDMONTON (MARCH)	<u>4</u>	<u>4</u>	<u>9</u>
TOTAL:	104 (64%)	37 (22.5%)	22 (13.5%)

2. ANALYSIS OF PUBLIC INPUT

2.1 Major Classes of Concern

A concern, by definition, is considered as any message that conveys anxiety, uneasiness or worry. In assessing the various inputs to the public hearings, a certain element of subjectivity was inevitable in attempting to identify expressions of concern. Nevertheless, a great many statements made during the public hearings were indicative of concern over a number of specific items related to pesticide use and these were readily identified for analysis. The input used to obtain an assessment and analysis of concerns included briefs both written and oral as well as subsequent comments made under questioning by the Authority.

The many different opinions expressed during the hearings are readily identifiable as components of several major "themes" that recurred continuously. These major themes are identified in Table 2 which has grouped opinions expressed into seven major classes. Thus when each major theme was touched upon during a brief or other form of input, a point was given to that class once (and only once, regardless of the number of times it was expressed during that particular input). Table 2 represents the overall degree of emphasis placed upon these major themes throughout the public hearings. It should be noted that other factors besides the frequency of its presentation are important in evaluating a point of view.

As indicated in Table 2, the most frequently recurring concern was that related to human health, comfort and productivity. This was emphasized more than twice as often as the next in order of frequency, that of adverse effects of pesticide use, and more than three times as often as those over packaging and marketing, public education and awareness. Pesticide research and evaluation as well as legislation and regulations were a good deal lower in ranking while pesticide application and non-chemical alternatives occupied an intermediate position on the scale of expression. As a general rule, those who found little fault with current pesticide regulations and use practices, and who supported continued pesticide use, made the greatest mention of concern over continued human health, comfort and productivity (Class 1). Those of the public who were more critical of the current situations tended to fall into the lower frequency classes.

2.1.1 Human Health, Comfort and Productivity

This group incorporated a number of aspects related to food and fibre production, to human health and physical comfort in Alberta and throughout the world. Fundamentally important was the concept that shortage, restrictions and/or elimination of pesticides would lead to declines in food and fibre production and to a failure to discharge Alberta's "moral obligation" to meet growing world demand for food. Any expression of concern about controlling specific pests such as wild oats, rats and coyotes was considered to reflect this basic theme. Also included were fears that the incidence of certain insect-borne diseases and illnesses would increase if pesticides were not used to control their vectors.

Associated with these concerns were those involving economic viability of farms, individual businesses and even whole social or organizational groups. The loss of labour-saving benefits of pesticides was considered very important to farmers, to spokesmen for the nursery and greenhouse industries and to the sugar beet industry, for example.

Of the opposite sympathy but included in this general class were thoughts regarding the pressures being placed on Alberta's production by a rapidly expanding world population, an expansion which may be forcing a total commitment to pesticide products. Also incorporated were fears about the increasing drain upon world energy supplies by modern farming techniques which include chemical pesticide use. Further there were apprehensions over the possibility of higher pesticide costs and even major pesticide shortages brought about by failing energy supplies, which could lead to loss of economic viability of family farms through reduced crop yields or reduced profit margins.

2.1.2 Adverse Effects of Pesticide Use

This major class of concerns involved the potential harmful effects of a direct and indirect nature on non-target species, including man. The adverse effects both short and long-term applied to this category. By extension, this grouping also included concern about the integrity of the natural environment and man's interference with natural ecosystems, particularly the fear that increasing mono-cultural farm practices were reducing the diversity of plant and animal species, thereby altering the natural balance among living species to the ultimate detriment of man.

Incorporated into this class were such items as the alteration of natural habitats, declines in population of species, build-up of pesticide residues in soil, air and water, toxic effects on humans and non-target organisms. Specific references to roadside and right-of-way spraying programs, to mosquito spraying and coyote control programs were made with regard to their effects on various organisms. Frequently mentioned was the plight of insect-eating birds, larger birds-of-prey, honeybees, various beneficial insects and natural predators. Also included were the many human health hazards, especially with regard to the mutagenic and carcinogenic properties of pesticides, the safety of commercial and non-commercial pesticide applicators, safety equipment and testing facilities.

This particular group accounted for 16.6% of the major concerns expressed during the hearings.

2.1.3 Packaging and Marketing

This major theme, referred to as Class 3, focussed upon inadequate labelling of pesticide containers, the size, shape and efficiency of the containers and various marketing procedures including promotion, advertising and retail sales. This group represented 11.5%.

Pesticide labels were frequently discussed, concentrating on practical problems such as print size, clarity and content of the instructions, and included comments on lack of emphasis on safety procedures, toxicity, environmental hazards and applicability to urban situations. The excessive volumes of pesticides sold in containers for home and garden use were emphasized as being a cause for overuse in urban situations. The drift hazards and misuse associated with convenient aerosol spray cans were also mentioned in the urban context. The lack of non-returnable or reuseable containers and the associated dangers of environmental contamination from discarded containers were points that were also included in this major class.

Various marketing practices were remarked upon. The proliferation of brand names for a few similar formulations was one and this was cited as a possible cause for confusion among users. Apprehension was also voiced over what appeared to be an excessive promotion of chemical pest control methods by government as compared to alternative methods and excessive advertising by chemical companies.

The retailing of pesticide products was another source of anxiety with an emphasis on the lack of control over the sale of pesticides in food stores, the standard of purity for foods imported for sale in Canada and the general over-the-counter availability of many potent, poisonous and extremely toxic compounds.

2.1.4 Public Education and Awareness

Table 2 indicates that 11.1% of the concerns expressed dealt with the lack of public knowledge and awareness of pesticides, their use and their potential harmful effects. This group of comments specifically cited the lack of awareness of environmental and human health hazards, of proper safety precautions, of correct application procedures and of proper disposal of surplus chemicals and containers.

Not only was there an emphasis on the general public's lack of understanding but also on the failure of retail outlets to provide proper direction to their customers. The absence of a sound public educational program, including rural and urban extension programs as well as school classes to teach youngsters about modern agriculture, pesticides, and the environment were cause for considerable worry. Government and industry were faulted for such a lack of programs. Existing extension programs were also criticized as failing to adequately emphasize the use of biological, cultural and other non-chemical pest control methods. In addition, several people deplored the lack of a centralized pesticide information centre in urban areas where advice could be easily obtained by domestic users of pesticides.

Comments regarding the poor image of the farmer as despoiler of the natural environment and the improper use of pesticides by urban dwellers were included in this general class. Finally, a critique of the role of Alberta Agriculture and its extension advisors in pesticide use, particularly the District Agriculturists, was included among the comments involved with public education and awareness.

2.1.5 Pesticide Application and Non-Chemical Alternatives

The fifth most frequently expressed concern theme (10.2%) basically involved the lack of a demonstrated need to use a pesticide as well as the lack of effective controls over certain uses and the degree of attention paid to non-chemical pest control techniques that are currently

available. Remarks were made on the current emphasis on "perfection" with regard to food quality, complete elimination of vegetation on rights-of-way and roadsides, perfection in the maintenance of homes and gardens with little regard for "economic threshold" levels of damage. There was also much discussion of the "crisis application" situation wherein a pesticide is applied on a massive scale in response to the emergence of a pest population.

Associated with these were remarks that in many situations the need to use a pesticide is not properly established. Included here were coyote and wolf control, fungicide use, and in the case of some "organic" farmers, any sort of agricultural pesticide at all. Criticisms were also levelled at indiscriminate use and careless pesticide applications on the part of commercial applicators, cities, towns and domestic users; there was a plea for accountability on the part of those who misuse pesticides.

Finally, the failure to use feasible alternatives to the "blanket application" of pesticides was commented upon by many participants.

2.1.6 Pesticide Research and Evaluation

A frequently recurring theme throughout the public hearings was related to pesticide research and evaluation. This comprised 8.5% of the major concerns voiced during the proceedings. Within this group were expressions of dissatisfaction with programs and policies related to research and development and the subsequent evaluation of products at federal and provincial government levels and by industry. Comments included lack of sufficient studies on efficacy of pesticides; lack of proper evaluation of adverse effects on non-target species; lack of research on biological pest control methods; lack of benefit/cost studies on pesticides; and lack of research funds for private research foundations and scientists. Foremost among these concerns was the lack of emphasis at the registration level of the impact of the pesticide on wildlife.

Within the Alberta situation there was considered to be insufficient testing of a pesticide under Alberta conditions and a lack of data on pesticide use, including quantities and types used, time and location of use and the intended target. Doubts about the adequacy of a pesticide review by the Environment Conservation Authority and its ability to influence government regulations were also placed in this grouping.

Also included were suspicions over the non-existence, forced confidentiality and unavailability of pesticide data from private companies and from government and the lack of effective testing of pesticide spray equipment.

Finally, on the other side of the ledger, some people feared that the decision on whether or not to suspend a controversial product might be based on emotional public response rather than upon factual scientific evidence.

2.1.7 Existing Pesticide Legislation and Regulations

The seventh and last major class of concerns dealt with the inadequacies of existing pesticide legislation, the associated regulations and their enforcement in Alberta. This group commented on the lack of regulations designed to protect fish, wildlife and other components of the natural environment. It also charged a lack of overall consistency in Alberta policies on pesticide use as well as between Alberta and Federal regulations. The Alberta Agricultural Chemicals Act and The Noxious Weed Control Act were cited as being ineffective. There were also stated to be anomalies over the legal definitions of pests and nuisance animals and the often harsh requirements of the law that required a landowner to eliminate such pests. Concern was also expressed over the small number of inspectors available to enforce Alberta pest control regulations and the lack of input from farmers to government committees charged with policy review and decision-making on pest control issues.

Another large group directed their attention to the laxity of restrictions governing retailing and use of pesticides, testing and researching for Alberta conditions and the lack of co-ordination of various government departments associated with pest control. The lack of an efficient review board was also cited.

Finally, there were opposing viewpoints which expressed fears that too much government interference into pesticide use would eliminate "free trade" practices in Alberta. These and other views associated with legislation and regulation accounted for 7.2% of the total of major concerns expressed at the public hearings.

TABLE 2
FREQUENCY OF EXPRESSION OF MAJOR CONCERN CLASSES
AT PUBLIC HEARINGS ON PESTICIDE AND HERBICIDE USE IN ALBERTA

<u>Major Concern Class</u> (Ranked in Order of Importance)	<u>Frequency of Expression</u>	
	<u>Number</u>	<u>Percent</u>
1. Human Health, Comfort and Productivity	82	34.9%
2. Adverse Effects of Pesticide Use	39	16.6%
3. Packaging and Marketing	27	11.5%
4. Public Education and Awareness	26	11.1%
5. Pesticide Application and Non-Chemical Alternatives	24	10.2%
6. Pesticide Research and Evaluation	20	8.5%
7. Pesticide Legislation and Regulations	<u>17</u>	<u>7.2%</u>
TOTAL:	235	100.0%

2.2 Publicly-Generated Recommendation

The concern that a contributor to the public hearings expresses regarding a certain topic may or may not prompt that individual to propose a recommendation. If the subject is familiar, or his feelings are strong, then a recommendation is likely to be made for its reduction or elimination. If, however, the concern is one of a more philosophical or ethical nature, or relates to a topic with which the participant is insufficiently familiar, then suggestions or recommendations are either not made or may only indirectly relate to the original subject. This was evident during the hearings on pesticide and herbicide use in Alberta where such widespread major concerns as the adverse effects of pesticides usually produced recommendations concerning legislation, education, marketing and other practical aspects of pesticide use. For this reason, the many recommendations made in briefs to the public hearings are considered separately in the succeeding paragraphs.

In assessing this important aspect of public input, several categories of recommendations have been recognized. Each recommendation was enumerated and placed in an appropriate category, thus providing a basic framework to assist the Authority in composing its recommendations to the Government of Alberta on pesticide and herbicide use.

A brief discussion of these recommendations is given in the following sections. The individual breakdown of recommendations in each major recommendation group is presented as a series of tables comprising Appendix IV of this final report.

2.2.1 Public Education and Awareness

Table 3 indicates the major groupings of recommendations derived from the public input. The greatest number of recommendations at the public hearings concerned the need for greater education of the ecological and human hazards, safety, proper application and other aspects of pesticide use on the part of all users. They covered a wide range of thought on methods of improving and increasing public awareness of pesticides. Extension and curriculum courses were emphasized by many. Table 1 of Appendix IV provides a more comprehensive indication of the strength and type of recommendations made on this aspect of pesticide use.

2.2.2 Pesticide Research and Evaluation

14.1% of the recommendations made (Table 3) belonged to this group. Table 2 in Appendix IV indicates that the most often expressed desire was for more research on the adverse effects of pesticides such as toxicity, carcinogenicity and residual build-up. More monitoring programs and better monitoring equipment were also highly recommended. Greater consideration of Alberta's environmental conditions when testing compounds was also desired by many, as was the desire for greater allocation of research funds for private research to ensure comprehensive testing of products and their potential adverse effects. Establishment of an interdisciplinary pesticides monitoring agency to co-ordinate and evaluate research was also one of the more important suggestions.

2.2.3 Pesticide Application

The application of pesticides accounted for 65 recommendations or 11.2% of the total expressed. This group covered a wide range of pesticide uses but all expressed a desire for voluntary guidelines as opposed to government control. Most frequently desired, as shown in Appendix IV Table 3 was the minimizing of the use of pesticides to reduce widespread environmental impacts and the avoidance or cautious use of the more dangerous pesticides. The continuation of pesticide use to maintain farm productivity was considered important as was the special plight of the beekeeper and finally the disposal of containers and surplus chemicals including establishment of centralized disposal centres.

2.2.4 Use of Non-Chemical Methods of Pest Control

This category represented 11.2% of the recommendations received. Twenty-three were concerned with more use of cultural and mechanical pest control methods; thirteen with more use of biological control; and twenty-one with a greater effort and funding to develop such methods. Establishment of a biological research centre was one of the more comprehensive recommendations while others were aimed at promotion of non-chemical methods of specific user groups and in different ways. A more complete assessment can be seen in Appendix IV.

2.2.5 Packaging and Labelling of Pesticides

Packaging and labelling represented another basic grouping and was the major emphasis of 10.6% of the total number.

The breakdown, as shown in Appendix IV Table 5 represents a wide range of ideas on methods of improving packaging and labelling as well as restricting current practices. Many suggestions concerned the standardization of formulations, volumes and package sizes and the provision of more information on labels. Comments promoting reusable containers were to some extent countered by those recommending that reuse be prevented. A general concern for safety of the user and for potential environmental damage appeared to underlie most of the recommendations in this group.

2.2.6 Pesticide Advertising and Retail Sales

Fifty-nine recommendations were classified as pertinent to pesticide advertising and retail sales. Table 6 of Appendix IV indicates that training and licensing of retail outlets and retailers accounted for 39% of these, showing a heavy emphasis on this aspect of retailing. Recommendations were also made regarding the desirability of centralizing retail sales of pesticides to these licensed outlets and of restricting the number of outlets. Improvement of sales procedures, including distribution of safety equipment and collection of user information data were part of this major group as was the establishment of poison treatment centres at retail outlets. There were also suggestions that pesticide advertisements be modified or even eliminated entirely.

2.2.7 Government Controls in Pesticide Use

The seventh major group comprised those directed to government controls. This group as shown in Table 3 accounted for 59 of the recommendations or 8.8%. A wide range in type and topic of recommendations appeared in this category including many opposing ones such as those involved with mosquito control programs, roadside spray programs and spraying of public lands. The ones most repeatedly called for were more stringent controls by government on pesticide use. Bans were recommended on some programs and practices while greater control was advocated by many, including the licensing of farmers, banning of home and garden pesticide use, control over municipal spray programs and quality of sprayers being used.

2.2.8 Government Legislation and Policy

A much more evenly distributed set of recommendations comprise this eighth major recommendation group. Table 8 in Appendix IV shows the extent of variation which ranged from comments on greater public

input to proposals for an "Alberta Biocides Act." The special problems of beekeepers and of the greenhouse industry were listed along with establishment of a new public agency to advise the government on pesticide use. The role of the Alberta government in promoting pesticide manufacturing in the province, its liaison with the Federal government on pesticides policy and regulation and its stronger enforcement of existing regulations were promoted. There were suggestions that Alberta Agriculture realign its philosophy to a basis of ecological principles as well as that it work closer with the manufacturing industry. A total of 48 recommendations were placed in this major group, representing 8.2% of all recommendations received.

2.2.9 Predator Control and Wildlife Habitat

The last major group of recommendations dealt with pesticide use in wildlife habitats, problems with wildlife habitat conservation and with predator control. Table 3 indicates that 46 were concerned with this aspect of pesticide use. Table 9 of Appendix IV shows that the largest group promoted generally unlimited methods of controlling predators especially coyotes. These included airplane gunners, hunting by snowmobile, poisoning, trapping and shooting. In contrast were recommendations which desired restrictions on poisoning campaigns for various reasons. There were also varied views as to the level of responsibility for predator control and various bans were proposed on magpie poisoning, pesticide use near water bodies and poisoning of native fish.

Several recommendations dealt with the need to protect non-agricultural land for wildlife habitat and for the preservation of wildlife habitat on agricultural lands. Government programs were suggested to improve wildlife habitat in various areas of the province.

TABLE 3
FREQUENCY OF PUBLICLY-GENERATED RECOMMENDATIONS ON
PESTICIDE AND HERBICIDE USE IN ALBERTA

<u>Major Recommendation Group</u>	<u>Number</u>	<u>Frequency</u> (in percent)
1. Public Education and Awareness	104	17.9
2. Pesticide Research and Evaluation	82	14.1
3. Pesticide Application	65	11.2
4. Use of Non-Chemical Methods of Pest Control	65	11.2
5. Packaging and Labelling	62	10.6
6. Pesticide Advertising and Retail Sales	59	10.1
7. Government Controls in Pesticide Use	51	8.8
8. Government Legislation and Policy	48	8.2
9. Predator Control and Wildlife Habitat	<u>46</u>	<u>7.9</u>
TOTAL:	582	100.0%

APPENDIX III

PUBLIC OPINION SURVEY



During the spring and summer of 1975, shortly after the conclusion of the Authority's Public Hearings on the Use of Pesticides and Herbicides in Alberta, the Department of the Environment commissioned a comprehensive public opinion survey of Alberta citizens on matters pertaining to the Environment.

1. OBJECTIVES OF THE SURVEY

A principal stated objective of the survey was
"to assess the level and scope of public awareness with respect to a variety of matters related to the environment, its maintenance, preservation and improvement."

The survey was also intended to assess public attitudes with respect to the gravity of environmental damage and to discover specific demographic groups which might require a specific approach and/or effort in the area of information/awareness about the environment.

2. CONCERNS OVER PESTICIDES

Included among the matters related to the environment was the public's awareness of and attitudes towards the use of "pesticides" or "chemicals to control insects and plant diseases."

Questions were posed to the public as part of the survey to determine how much and what kind of information about pesticides was getting through to the residents of Alberta and how they were reacting to it.

3. METHODOLOGY OF THE SURVEY

The sampling technique used in the study was one which has been found to produce results approximate to what would have been obtained if every person in the survey area had been interviewed. It is also such that its susceptibility to error can be expressed mathematically.

In the sample design used in this case this error in 95 cases out of 100 will not exceed plus or minus 3%.

4. DEMOGRAPHIC CONSIDERATIONS

A breakdown of the demographic characteristics of the sample showed very close conformity to that exhibited by the Alberta 1971 census for the population of Alberta as a whole. Thus the opinions

expressed can be assumed to represent the different age and sex groupings in the same manner as they exist in the total population.

5. PUBLIC OPINIONS ON PESTICIDES

The survey showed that 87% of the respondents consider the environmental effects of the use of pesticides to be a matter of importance. Only a very small number of people representing 4% of the sample were unaware, or could not express an opinion on this matter.

Further analysis of this question showed similar responses from groups of different ages, different educational backgrounds and both sexes. It also appeared not to matter where the respondent lived, whether in small or large cities or which area of the province except that those living in the area south of the Trans Canada Highway were somewhat less concerned - 79% than any of the other groups or the population as a whole.

In response to another question it was found that 28% of the people could recall reading or hearing something about pesticides in the news media recently. In this case age appeared to be an important factor since over twice as many or 37% of those 65 years old and over had read or heard something whereas among those in the 18 to 24 years age group the number was 15.6%.

Again there was a fairly uniform response throughout the province but in this case a somewhat higher positive response came from the southern half of the province and somewhat lower response from the north.

In regard to the kinds of comments people could recall hearing, the one most frequently remembered had to do with mosquitos, followed by general remarks about adverse effects and comments concerning use and misuse of pesticides.

It appeared that the negative or adverse effects of pesticides was a matter of concern mostly in the 18 to 24 years and over 65 years age groups. Those in the 25 to 64 years groupings were somewhat more concerned over mosquito control.

Similarly the city response listed mosquito control most often; the towns-"adverse effects," and the rural areas-"use and misuse".

Finally there was again a noticeable divergence between the north and south with 41.4% of those living north of the Trans Canada Highway showing concern for the negative effects or danger from pesticides whilst less than half that number or 16.2% felt that way in the southern half of the province.

APPENDIX IV

TABULATED SUMMARY OF SUGGESTIONS, RECOMMENDATIONS AND OPINIONS PRESENTED TO THE HEARINGS



TABLE I
SUGGESTED RECOMMENDATIONS ON
PUBLIC EDUCATION AND AWARENESS

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. More consumer education on aspects of use and ecological effects	41	39.3
2. Increased farm extension course and field demonstrations	19	18.2
3. Alberta Dept. of Extension should institute pesticidal and environmental courses	8	7.6
4. More consumer education programs on alternative pest control methods	6	5.8
5. Pesticides advisory agency required in urban areas	6	5.8
6. Periodic upgrading of commercial applicator licences	4	3.8
7. Expand govt. sponsoring of training programs	4	3.8
8. Courses should be given on organic farming methods	3	2.9
9. More comprehensive ecological training of municipal pest control officers	3	2.9
10. Greater emphasis on environmental hazards, damage thresholds, non-chemical control in commercial applicator courses	3	2.9
11. Greater involvement of industry in continuing education programs	2	2.0
12. Studies on consumer awareness of non-chemical alternatives	2	2.0

TABLE 1 - continued

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
13. Greater availability of Alberta Agriculture publications to public	2	2.0
14. Revise educational philosophy of Alberta Agriculture and Extension Department	<u>1</u>	<u>1.0</u>
TOTAL:	104	100.0%

TABLE 2
SUGGESTED RECOMMENDATIONS ON
PESTICIDE RESEARCH AND EVALUATION

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. More research on adverse effects	25	30.5
2. Better pesticide monitoring programs and equipment for assessing environmental and human health hazards	8	9.7
3. Greater consideration of Alberta and Canada conditions in pesticide research	7	8.5
4. Greater allocation of funds for private research	6	7.3
5. Establish an interdisciplinary pesticides monitoring agency to review test data, evaluate products	6	7.3
6. Develop safer, more selective, less persistent pesticides	4	4.9
7. Develop new pesticides to enhance food production	4	4.9
8. All research data made available to public	3	3.7
9. Require manufacturers to support yield improvement claims	3	3.7
10. Develop and maintain communication between all pesticides expertise and all govt. agencies concerned with research and evaluation	3	3.7
11. Decision to ban a pesticide to be made only on scientific grounds	3	3.7
12. Scientific review of current registration requirements	3	3.7

TABLE 2 - continued

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
13. Grant permanent registration only upon receipt of environmental data	2	2.4
14. Establish economic benefits and cost/benefit ratios for all pesticides used	2	2.4
15. Review required of excessive provincial government expenditures on pesticide research	1	1.2
16. All research and evaluation costs borne by manufacturer	1	1.2
17. Require agricultural representation when considering banning of a product	<u>1</u>	<u>1.2</u>
TOTAL:	82	100.0%

TABLE 3
SUGGESTED RECOMMENDATIONS ON
PESTICIDE APPLICATION

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. Minimize use of pesticides and adverse effects	11	17.0
2. Improvements in safety and design of spray equipment	11	17.0
3. Avoid use of persistent and toxic pesticides	8	12.3
4. More cautious use practices to avoid ecological damage	5	7.7.
5. Continue pesticide use to maintain farm productivity	5	7.7
6. Notify local beekeepers 48 hrs. in advance of nearby spraying operations	5	7.7
7. Establish centralized disposal centres for surplus containers and chemicals	4	6.2
8. Greater control over disposal of containers and excess pesticides	3	4.6
9. Eliminate mosquito breeding grounds to remove necessity of mosquito control programs	3	4.6
10. Assess economic damage and benefits before pesticide application	3	4.6
11. Establish and maintain local beehive registries	2	3.1
12. Revert to smaller, mixed farming to reduce need for pesticides	1	1.5
13. Continued pesticide use to control biting flies and insects	1	1.5

TABLE 3 - continued

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
14. Contact qualified pesticides personnel before spraying	1	1.5
15. Restrict spraying of roadside legumes used as bee pasture	1	1.5
16. Re-calibrate aircraft spray equipment after each job	<u>1</u>	<u>1.5</u>
TOTAL:	65	100.0%

TABLE 4
SUGGESTED RECOMMENDATIONS ON
USE OF NON-CHEMICAL METHODS OF PEST CONTROL

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. More use and emphasis of cultural and mechanical controls	23	35.4
2. Greater effort and funding to develop and promote non-chemical alternatives	21	32.3
3. More use and emphasis of biological controls	13	20.0
4. Establish a provincial research institute of biological control	3	4.7
5. Leniency in restrictions on pesticides until sound alternative methods are developed	2	3.1
6. Only non-chemical control methods should be allowed in home and garden use	1	1.5
7. Investigate use of insects as a human food source	1	1.5
8. Require farmer to employ all available mechanical, cultural and biological controls before chemical use	<u>1</u>	<u>1.5</u>
TOTAL:	65	100.0%

TABLE 5
SUGGESTED RECOMMENDATIONS ON
PACKAGING AND LABELLING OF PESTICIDES

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. Standardization of formulation, volumes and measures required	15	24.2
2. More information needed for labels	15	24.2
3. Require improved packaging and labelling	6	9.7
4. Design containers to improve safety and facilitate disposal	5	8.2
5. Design containers for re-use	4	6.5
6. Prohibit aerosol containers	2	3.2
7. Review required of container sizes	2	3.2
8. Design containers to prevent re-use	2	3.2
9. Consult farmers to develop a legible, standardized label	2	3.2
10. Increase print size on label	2	3.2
11. Chemical name should be placed on label	2	3.2
12. Formulate pesticides according to differences in household and higher-order use	2	3.2
13. Attach information leaflet to a product to expand on label information	1	1.6
14. Eliminate pre-mixing of different chemicals	1	1.6
15. Ban liquid spray formulations	<u>1</u>	<u>1.6</u>
TOTAL:	62	100.0%

TABLE 6
SUGGESTED RECOMMENDATIONS ON
PESTICIDE ADVERTISING AND RETAIL SALES

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. Training and licensing of retail outlets and retailers	23	39.0
2. Stricter sales and advertising regulations	10	16.9
3. Sales outlets to collect data on sales and "user information"	8	13.5
4. Restrict number and type of retail sales outlets	6	10.2
5. Training and licensing of warehouse and storage personnel	2	3.4
6. Sales outlets to supply safety equipment to purchasers of toxic pesticides	2	3.4
7. Restrict sale of highly toxic pesticides to trained applicators	2	3.4
8. Include hazards, degradation rate and safety equipment required in pesticide advertisements	2	3.4
9. Sales on a "prescription" or "over-the-counter" basis only	1	1.7
10. Establish poison treatment centres at pesticide retail outlets	1	1.7
11. Eliminate large inventories of different brands of same pesticide	1	1.7
12. Prohibit promotion and advertising of pesticides	<u>1</u>	<u>1.7</u>
TOTAL:	59	100.0%

TABLE 7
SUGGESTED RECOMMENDATIONS ON
GOVERNMENT CONTROLS IN PESTICIDE USE

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. More stringent controls on chemical use	19	37.2
2. Restrict use of herbicides on rights-of-way, roadsides	5	9.7
3. Promote pesticide application by qualified applicators	3	5.9
4. Licensing of farm users of pesticides	3	5.9
5. Greater control of aerial applicators and their licensing	2	3.9
6. Greater control over municipal spray programs	2	3.9
7. Ban adult mosquito control programs	2	3.9
8. Better pre-inventory and planning of mosquito control programs	2	3.9
9. Permit use of approved pesticides on public lands	2	3.9
10. Inform public in advance of spraying public lands	2	3.9
11. Right-of-appeal by public to halt spraying of public lands	2	3.9
12. Discontinue blackfly larvae control programs in rivers	1	2.0
13. Establish weed free areas in province	1	2.0
14. Ban home and garden pesticides	1	2.0

TABLE 7 - continued

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
15. Increase number of plant inspectors at Alberta border crossings	1	2.0
16. Continuation of mosquito larvae control programs	1	2.0
17. More control over quality of spray equipment used	1	2.0
18. Availability to public of spray drift detection devices	<u>1</u>	<u>2.0</u>
TOTAL:	51	100.0%

TABLE 8
SUGGESTED RECOMMENDATIONS ON
GOVERNMENT LEGISLATION AND POLICY

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. Stronger pesticide laws required	5	10.4
2. Stronger enforcement and penalties regarding Alberta and federal regulations	5	10.4
3. Consistency and uniformity of Alberta and Federal regulations through constant liaison	5	10.4
4. Involvement of Alberta in manufacture, marketing and distribution of pesticides	5	10.4
5. An indemnity program to compensate beekeepers for losses caused by pesticide use	5	10.4
6. Availability of pesticide use data to public	4	8.3
7. Pesticide policy on basis of objective and scientific appraisal	4	8.3
8. Ecological laws and principles to be the basis of philosophy of Alberta Agriculture	3	6.3
9. Establish public agency with environmental representation to advise govt. on pesticide use and to act as watchdog	3	6.3
10. Further public hearings and input to government policy	2	4.1
11. Closer co-operation of industry and government to develop pest control guidelines	1	2.1
12. Unification and centralization of federal regulatory authorities	1	2.1

TABLE 8 - continued

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
13. Establish international agreements respecting pesticide legislation	1	2.1
14. Federal involvement in rat control program required	1	2.1
15. Continue practice of licensing commercial applicators	1	2.1
16. Subsidization of pesticide costs to farmer by Federal govt.	1	2.1
17. Recognition of high dependence of greenhouse industry on chemical control	<u>1</u>	<u>2.1</u>
TOTAL:	48	100.0%

TABLE 9
SUGGESTED RECOMMENDATIONS ON
PREDATOR CONTROL AND WILDLIFE HABITAT

<u>Recommendation</u>	<u>Frequency</u>	
	<u>Number</u>	<u>Percent</u>
1. Use unlimited methods to control predators	14	30.4
2. Restrict poisoning campaigns against predators	9	19.5
3. Instigation of govt. programs to improve wildlife habitat	4	8.8
4. Preservation of wildlife habitat in agricultural areas by govt.	3	6.5
5. Coyote control a local enforcement responsibility	3	6.5
6. Establish several predator-free areas in Alberta	2	4.3
7. Restrict hunting and trapping of predators	2	4.3
8. Prohibit poisoning of native fish	2	4.3
9. Protect non-agricultural land from pesticide use	2	4.3
10. Ban on poisons for magpie control	1	2.2
11. Poisoning of "killer" coyotes required	1	2.2
12. Control of problem wildlife by provincial officials	1	2.2
13. Prohibit spraying against biting flies in parks and in Green Zone	1	2.2
14. Ban on pesticide use in and within 1/4 mile of water bodies	<u>1</u>	<u>2.2</u>
TOTAL:	46	100.0%

APPENDIX V

PESTICIDE RESIDUE RESULTS

1971-72, 1972-73, & 1973-74



●

Health and Welfare
Canada

Santé et Bien-être social
Canada

Health Protection
Branch

Direction générale de la
protection de la santé

Bureau of Chem.
Ottawa, Ontario,
K1A 0L2.

CONFIDENTIAL

October 2, 1975.

Mr. J.B. Gurba,
Head, Crop Protection &
Pest Control Branch,
Plant Industry Division,
Alberta Dept. of Agriculture,
Agriculture Building,
9718 - 10th Street,
Edmonton, Alberta.

Dear Mr. Gurba:

Pesticide Residue Results

The National Monitoring Program (FMO₂) started by our Department in 1971 was intended to measure the level and incidence of certain pesticides within a given number of major foods.

The pesticides to be measured were selected on the basis of their high toxicity, persistence or extent of use or a combination of these factors. The foods sampled were taken from across the country on a statistically random basis, rather than from known problem areas as might be the case in our Surveillance Program. Consequently, the residues found probably approach the average residue levels likely to occur in the foods listed at point of sale.

Summaries of the computer print-outs of results for the years 1971-72, 1972-73 and 1973-74 are enclosed for your information. The results for the year 1974-75, although not yet available in this format, also indicate little change with residues well below our tolerance levels or practical residue limits.

Yours sincerely,

Peter R. Bennett

P.R. Bennett,
Division of Additives
and Pesticides.

Encl.

PHONE: (613)
995-6313

ALL INFORMATION CONTAINED
HEREIN IS UNCLASSIFIED

CHAIRMAN

ALBERTA ENVIRONMENT CONSERVATION AUTHORITY

November 12, 1975.

Mr. Peter R. Bennett,
Division of Additives and Pesticides,
Health Protection Branch,
Department of Health and Welfare,
Bureau of Chemical Safety,
Ottawa, Ontario. KIA 0L2

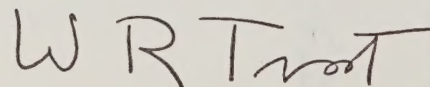
Dear Mr. Bennett:

You are familiar I believe with the hearings the Environment Conservation Authority has undertaken at the request of the Government of Alberta into the use of pesticides in Alberta over these past several years. The hearings are now complete and the Authority is in process of preparing its Report and Recommendations to Government upon its findings. We have had access to the National Monitoring of Pesticide Residues that has been done under the auspices of the National Monitoring Program started by the Canada Department of Health and Welfare and have found its data to be helpful and of interest to us. We are also familiar with the publication of data from the National Monitoring Program in the Report of the Royal Commission on the Use of Herbicides and Pesticides in British Columbia.

It would be most helpful if it were possible for the Authority to use the data produced by the National Monitoring Program in its Report as the B.C. Royal Commission already has done. May I therefore request permission to use the data attached in a memorandum to Mr. Gurba, Head of the Crop Protection and Pest Control Branch, Department of Agriculture, on October 2nd, 1975. The use of the data will be helpful to our Report to Government. There is a strong likelihood, if not a near certainty, that our Report to Government will be tabled and made available to the public by the Minister of the Environment.

I hope it will be possible for you to release this information to the Authority for possible inclusion in whole or in part in the Report and Recommendations of the Authority to the Government of Alberta.

Yours sincerely,



DR. W. R. TROST,
Chairman.



Health and Welfare
Canada

Santé et Bien-être social
Canada

Health Protection
Branch

Direction générale de la
protection de la santé

Our File No. 910-1-1

Bureau of Chemical Safety,
Ottawa, Ontario,
K1A 0L2.

December 18, 1975.

Dr. W.R. Trost,
Chairman,
Alberta Environment Conservation
Authority,
2100 College Plaza, Tower 3,
8215 - 112th Street,
Edmonton, Alberta,
T6G 2M4.

Dear Dr. Trost:

Thank you for your letter dated November 12, 1975 concerning the use of residue data from our National Monitoring Program in your report to the Alberta Government.

I have now obtained the approval of Dr. A.B. Morrison, the Assistant Deputy Minister for the Health Protection Branch, for the release and use of the data you refer to in your letter. For your information and use, I am also enclosing a copy of a recent article on pesticide residues in the total diet of Canadians, published in Pesticide Science, Vol. 6, 1975.

Yours sincerely,

P.R. Bennett,
Division of Additives
and Pesticides.

Encls.

100
YEARS OF HEALTH
PROTECTION



CENTENNAIRE DE
LA PROTECTION DE LA SANTÉ

NATIONAL MONITORING OF PESTICIDE RESIDUES

The numbers of samples of named foods, which were analysed for the presence of the pesticides listed, are given according to the residue levels found which fall within the residue ranges specified. In each case the first residue range, starting at 0.000-, includes those samples for which residues of the pesticide were looked for but not found, according to the sensitivity of the analytical method used.

APRIL, 1971 to MARCH, 1972

Commodity	Number of Samples	Number of Samples Containing Residues Within the Following Residue Ranges (ppm)					
		0.000-	0.026-	0.051-	0.101-	0.151-	>
		0.025	0.050	0.100	0.150	0.200	0.200

1. Aldrin plus Dieldrin

beef	17	17	0	0	0	0	0
butter	3	3	0	0	0	0	0
cabbage	21	21	0	0	0	0	0
carrots	21	21	0	0	0	0	0
chicken	7	7	0	0	0	0	0
chicken eggs	9	9	0	0	0	0	0
flour	10	10	0	0	0	0	0
milk	31	30	1	0	0	0	0
pork	8	8	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0

2. Chlordane (cis & trans isomers only)

butter	3	3	0	0	0	0	0
cabbage	21	21	0	0	0	0	0
carrots	21	21	0	0	0	0	0
chicken eggs	9	9	0	0	0	0	0
milk	29	29	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0

3. Endrin

tomatoes	17	17	0	0	0	0	0
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4. Fensulfothion

cabbage	21	21	0	0	0	0	0
carrots	21	21	0	0	0	0	0
potatoes	35	35	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the Following Residue Ranges (ppm)					
		0.000-	0.026-	0.051-	0.101-	0.151-	>
		0.025	0.050	0.100	0.150	0.200	0.200

5. Heptachlor Plus Heptachlor Epoxide

beef	1	1	0	0	0	0	0
butter	3	3	0	0	0	0	0
cabbage	21	21	0	0	0	0	0
carrots	21	21	0	0	0	0	0
chicken	7	7	0	0	0	0	0
chicken eggs	9	9	0	0	0	0	0
flour	10	10	0	0	0	0	0
milk	30	30	0	0	0	0	0
pork	4	4	0	0	0	0	0
potatoes	35	35	0	0	0	0	0

6. Phorate (Thimet)

potatoes	35	35	0	0	0	0	0
		0.000-	0.051-	0.101-	0.201-	0.301-	>
		0.050	0.100	0.200	0.300	0.500	0.500

1. BHC (beta)

beef	16	16	0	0	0	0	0
butter	3	3	0	0	0	0	0
chicken	3	3	0	0	0	0	0
flour	10	10	0	0	0	0	0
milk	19	19	0	0	0	0	0
pork	8	8	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	1	1	0	0	0	0	0

2. BHC (gamma)

beef	17	16	0	0	0	0	1 (at 1.03)
butter	3	3	0	0	0	0	0
chicken	3	3	0	0	0	0	0
flour	10	10	0	0	0	0	0
milk	31	31	0	0	0	0	0
pork	8	8	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	1	1	0	0	0	0	0

3. Total BHC Isomers

beef	17	16	0	0	0	0	1 (at 1.03)
butter	3	3	0	0	0	0	0
chicken	3	3	0	0	0	0	0
chicken eggs	1	1	0	0	0	0	0
flour	10	10	0	0	0	0	0
milk	31	31	0	0	0	0	0
pork	8	8	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	1	1	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the Following Residue Ranges (ppm)					
		0.000-	0.051-	0.101-	0.201-	0.301-	>
		0.050	0.100	0.200	0.300	0.500	0.500

4. Chlorfenvinphos

potatoes	35	35	0	0	0	0	0
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5. Coumaphos

beef	17	17	0	0	0	0	0
milk	29	29	0	0	0	0	0

6. 2,4-D

flour	10	10	0	0	0	0	0
milk	29	29	0	0	0	0	0
potatoes	35	35	0	0	0	0	0

7. Diazinon

cabbage	21	21	0	0	0	0	0
carrots	21	21	0	0	0	0	0
chicken	7	7	0	0	0	0	0
oranges	5	5	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	35	35	0	0	0	0	0

8. Disulfoton

potatoes	35	35	0	0	0	0	0
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9. Parathion

flour	10	10	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0

0.000-	0.501-	1.001-	1.501-	3.501-	>
0.500	1.000	1.500	3.500	5.000	5.000

1. Azinphos-Methyl

apples	17	17	0	0	0	0	0
oranges	5	5	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0

2. Carbaryl

apples	17	17	0	0	0	0	0
beans	5	5	0	0	0	0	0
(fresh or frozen)							
cabbage	21	21	0	0	0	0	0
carrots	21	21	0	0	0	0	0
chicken	7	7	0	0	0	0	0
flour	10	10	0	0	0	0	0
potatoes	35	35	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the Following Residue Ranges (ppm)					
		0.000-	0.501-	1.001-	1.501-	3.501-	>
		0.500	1.000	1.500	3.500	5.000	5.000

3. Total DDT Plus Metabolites

apples	5	5	0	0	0	0	0
beef	17	17	0	0	0	0	0
butter	3	3	0	0	0	0	0
carrots	3	3	0	0	0	0	0
chicken	7	7	0	0	0	0	0
chicken eggs	5	5	0	0	0	0	0
flour	10	10	0	0	0	0	0
milk	32	32	0	0	0	0	0
pork	8	8	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0

4. Dicofol

apples	6	6	0	0	0	0	0
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5. Total Endosulfan Plus Metabolites

apples	17	17	0	0	0	0	0
beans	5	5	0	0	0	0	0
(fresh or frozen)							
cabbage	21	21	0	0	0	0	0
carrots	21	21	0	0	0	0	0
chicken	1	1	0	0	0	0	0
chicken eggs	1	1	0	0	0	0	0
flour	3	3	0	0	0	0	0
milk	29	29	0	0	0	0	0
pork	1	1	0	0	0	0	0
potatoes	35	35	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0

6. Phosmet

apples	1	1	0	0	0	0	0
tomatoes	1	1	0	0	0	0	0

7. Lead

potatoes	35	35	0	0	0	0	0
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8. Malathion

flour	10	10	0	0	0	0	0
milk	29	29	0	0	0	0	0
pork	8	8	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the Following Residue Ranges (ppm)					
		0.000-0.500	0.501-1.000	1.001-1.500	1.501-3.500	3.501-5.000	> 5.000
9. <u>Maneb</u>							
potatoes	35	35	0	0	0	0	0
10. <u>Methoxychlor</u>							
apples	1	1	0	0	0	0	0
11. <u>Zineb</u>							
potatoes	35	35	0	0	0	0	0
tomatoes	17	17	0	0	0	0	0
		0.000-1.000	1.001-2.000	2.001-3.000	3.001-4.000	4.001-10.000	> 10.000

1. Piperonyl Butoxide

flour	10	10	0	0	0	0	0
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The following numbers of samples of food were also examined for the presence of chlorinated hydrocarbon insecticides or organo-phosphorus insecticides by a non-specific group method. No residues were found in these samples:

Food Commodity	Number of Samples Examined For:	
	Chlorinated-Hydrocarbon Insecticides	Organo-Phosphorus Insecticides
apples	6	6
beans (fresh or frozen)	5	5
beef	2	7
cabbage	10	17
carrots	15	18
chickens	-	4
chicken eggs	1	4
flour	4	10
milk	3	24
oranges	1	1
pork	-	6
potatoes	23	35
tomatoes	15	16

Samples where residues were found were then analysed by a specific method and are listed in the tables under specific pesticides.

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000-	0.026-	0.051-	0.101-	0.151-	>
		0.025	0.050	0.100	0.150	0.200	0.200

1. Aldrin plus Dieldrin

beef	45	45	0	0	0	0	0
butter	25	23	2	0	0	0	0
cabbage	28	28	0	0	0	0	0
carrots	29	27	2	0	0	0	0
chicken	28	25	2	1	0	0	0
chicken eggs	31	31	0	0	0	0	0
flour	37	37	0	0	0	0	0
milk	56	52	4	0	0	0	0
oils	17	17	0	0	0	0	0
pork	38	38	0	0	0	0	0
potatoes	43	43	0	0	0	0	0
tomatoes	43	43	0	0	0	0	0

2. Chlordane

butter	25	25	0	0	0	0	0
cabbage	28	28	0	0	0	0	0
carrots	29	29	0	0	0	0	0
chicken eggs	31	31	0	0	0	0	0
milk	56	56	0	0	0	0	0
potatoes	43	40	2	1	0	0	0
tomatoes	43	43	0	0	0	0	0

3. Endrin

tomatoes	43	43	0	0	0	0	0
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4. Fensulfothion

cabbage	28	28	0	0	0	0	0
carrots	29	29	0	0	0	0	0
potatoes	43	43	0	0	0	0	0

5. Heptachlor plus Heptachlor Epoxide

beef	6	6	0	0	0	0	0
butter	25	25	0	0	0	0	0
cabbage	28	28	0	0	0	0	0
carrots	29	29	0	0	0	0	0
chicken	28	26	0	1	0	0	1
chicken eggs	31	31	0	0	0	0	0
flour	37	37	0	0	0	0	0
milk	56	56	0	0	0	0	0
oils	17	17	0	0	0	0	0
pork	2	1	1	0	0	0	0
potatoes	43	43	0	0	0	0	0

6. Phorate

potatoes	43	43	0	0	0	0	0
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Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000- 0.050	0.051- 0.100	0.101- 0.200	0.201- 0.300	0.301- 0.500	> 0.500
<u>1. BHC (beta)</u>							
beans (fresh or frozen)	1	1	0	0	0	0	0
beef	34	34	0	0	0	0	0
butter	5	5	0	0	0	0	0
chicken	2	2	0	0	0	0	0
flour	30	30	0	0	0	0	0
milk	23	23	0	0	0	0	0
pork	35	35	0	0	0	0	0
potatoes	43	43	0	0	0	0	0
<u>2. BHC (gamma)</u>							
beans (fresh or frozen)	1	1	0	0	0	0	0
beef	45	44	0	0	0	1	0
butter	5	5	0	0	0	0	0
chicken	2	2	0	0	0	0	0
flour	37	34	2	1	0	0	0
milk	56	56	0	0	0	0	0
pork	38	38	0	0	0	0	0
potatoes	43	43	0	0	0	0	0
<u>3. BHC (total)</u>							
beans (fresh or frozen)	1	1	0	0	0	0	0
beef	45	42	1	1	0	1	0
butter	15	15	0	0	0	0	0
carrots	1	0	1	0	0	0	0
chicken	5	5	0	0	0	0	0
flour	37	35	1	1	0	0	0
milk	56	56	0	0	0	0	0
pork	38	37	0	0	0	0	1
potatoes	43	43	0	0	0	0	0
tomatoes	1	1	0	0	0	0	0
<u>4. Chlorfenvinphos</u>							
potatoes	43	43	0	0	0	0	0
<u>5. Coumaphos</u>							
beef	45	45	0	0	0	0	0
milk	56	56	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000-	0.051-	0.101-	0.201-	0.301-	>
		0.050	0.100	0.200	0.300	0.500	0.500

6. Diazinon

cabbage	28	28	0	0	0	0	0
carrots	29	29	0	0	0	0	0
chicken	29	28	0	0	1	0	0
oranges	23	23	0	0	0	0	0
potatoes	42	42	0	0	0	0	0
tomatoes	43	43	0	0	0	0	0

7. Disulfoton

potatoes	43	43	0	0	0	0	0
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8. Parathion

carrots	5	5	0	0	0	0	0
flour	37	37	0	0	0	0	0
oranges	4	1	1	1	0	0	1
tomatoes	43	43	0	0	0	0	0

9. 2,4-D

flour	37	37	0	0	0	0	0
milk	56	56	0	0	0	0	0
potatoes	43	43	0	0	0	0	0

0.000-	0.501-	1.001-	1.501-	3.501-	>
0.500	1.000	1.500	3.500	5.000	5.000

1. Azinphos-Methyl

apples	26	26	0	0	0	0	0
oranges	21	21	0	0	0	0	0
tomatoes	43	43	0	0	0	0	0

2. Carbaryl

apples	26	26	0	0	0	0	0
beans	25	25	0	0	0	0	0
(fresh or frozen)							
cabbage	28	28	0	0	0	0	0
carrots	29	29	0	0	0	0	0
chicken	28	28	0	0	0	0	0
flour	37	37	0	0	0	0	0
potatoes	43	43	0	0	0	0	0

3. DDT (total)

apples	3	3	0	0	0	0	0
beans	3	3	0	0	0	0	0
(fresh or frozen)							

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000- 0.500	0.501- 1.000	1.001- 1.500	1.501- 3.500	3.501- 5.000	> 5.000
3. <u>DDT (cont'd.)</u>							
beef	45	45	0	0	0	0	0
butter	18	18	0	0	0	0	0
carrots	17	16	0	1	0	0	0
chicken	26	25	0	0	1	0	0
chicken eggs	7	7	0	0	0	0	0
flour	37	37	0	0	0	0	0
milk	56	56	0	0	0	0	0
oils	2	2	0	0	0	0	0
oranges	1	0	1	0	0	0	0
pork	38	38	0	0	0	0	0
potatoes	43	43	0	0	0	0	0
tomatoes	43	43	0	0	0	0	0
4. <u>Dicofol</u>							
apples	3	3	0	0	0	0	0
oranges	3	3	0	0	0	0	0
5. <u>Endosulfan</u>							
apples	26	26	0	0	0	0	0
beans (fresh or frozen)	25	25	0	0	0	0	0
cabbage	28	28	0	0	0	0	0
carrots	29	29	0	0	0	0	0
milk	56	56	0	0	0	0	0
potatoes	43	43	0	0	0	0	0
tomatoes	43	43	0	0	0	0	0
6. <u>Lead</u>							
potatoes	43	43	0	0	0	0	0
7. <u>Malathion</u>							
flour	37	37	0	0	0	0	0
milk	56	56	0	0	0	0	0
oils	1	1	0	0	0	0	0
oranges	2	2	0	0	0	0	0
pork	38	38	0	0	0	0	0
tomatoes	43	43	0	0	0	0	0
8. <u>Maneb</u>							
potatoes	43	43	0	0	0	0	0
9. <u>Phosmet</u>							
apples	7	7	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000-	0.501-	1.001-	1.501-	3.501-	>
		0.500	1.000	1.500	3.500	5.000	5.000

10. Zineb

potatoes	43	43	0	0	0	0	0
tomatoes	43	43	0	0	0	0	0
		0.000-	1.001-	2.001-	3.001-	4.001-	>
		1.000	2.000	3.000	4.000	10.000	10.000

1. Captan

apples	17	17	0	0	0	0	0
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2. Piperonyl Butoxide

flour	37	37	0	0	0	0	0
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The following numbers of samples of food were also examined for the presence of chlorinated hydrocarbon insecticides or organo-phosphorus insecticides by a non-specific group method. No residues were found in these samples:

Food Commodity	Number of Samples Examined For:	
	Chlorinated-Hydrocarbon Insecticides	Organo-Phosphorus Insecticides
beef	-	3
butter	-	1
chicken	-	3
chicken eggs	1	1
flour	4	4
milk	-	1
oils	2	2
pork	-	1
tomatoes	-	2

Samples where residues were found were then analysed by a specific method and are listed in the tables under specific pesticides.

NATIONAL MONITORING OF PESTICIDE RESIDUES

The numbers of samples of named foods, which were analysed for the presence of the pesticides listed, are given according to the residue levels found which fall within the residue ranges specified. In each case the first residue range, starting at 0.000-, includes those samples for which residues of the pesticides were looked for but not found, according to the sensitivity of the analytical method used.

APRIL 1973 to MARCH 1974

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000-	0.026-	0.051-	0.101-	0.151-	>
		0.025	0.050	0.100	0.150	0.200	0.200

1. Aldrin plus Dieldrin

beef	31	30	1	0	0	0	0
butter	28	21	7	0	0	0	0
cabbage	26	26	0	0	0	0	0
carrots	26	25	1	0	0	0	0
chicken	25	22	2	0	0	0	1
chicken eggs	28	28	0	0	0	0	0
flour	28	28	0	0	0	0	0
milk	40	35	3	2	0	0	0
oils	22	22	0	0	0	0	0
pork	38	37	0	1	0	0	0
potatoes	32	32	0	0	0	0	0
tomatoes	40	40	0	0	0	0	0

2. Chlordane

butter	28	28	0	0	0	0	0
cabbage	26	26	0	0	0	0	0
carrots	26	26	0	0	0	0	0
chicken eggs	28	28	0	0	0	0	0
milk	42	42	0	0	0	0	0
potatoes	32	32	0	0	0	0	0
tomatoes	41	41	0	0	0	0	0

3. Endrin

cabbage	2	1	1	0	0	0	0
carrots	2	2	0	0	0	0	0
oils	1	1	0	0	0	0	0
tomatoes	41	41	0	0	0	0	0

4. Fensulfothion

cabbage	26	26	0	0	0	0	0
carrots	26	26	0	0	0	0	0
potatoes	32	32	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000-0.025	0.026-0.050	0.051-0.100	0.101-0.150	0.151-0.200	> 0.200

5. Heptachlor plus Heptachlor Epoxide

beef	6	6	0	0	0	0	0
butter	28	28	0	0	0	0	0
cabbage	26	26	0	0	0	0	0
carrots	26	26	0	0	0	0	0
chicken	25	25	0	0	0	0	0
chicken eggs	28	28	0	0	0	0	0
flour	28	28	0	0	0	0	0
milk	40	37	3	0	0	0	0
oils	21	21	0	0	0	0	0
potatoes	32	31	0	1	0	0	0

6. Phorate

potatoes	32	32	0	0	0	0	0
			0.000-0.050	0.051-0.100	0.101-0.200	0.201-0.300	0.301-0.500
							> 0.500

1. BHC (beta)

beef	24	24	0	0	0	0	0
butter	1	1	0	0	0	0	0
chicken	4	4	0	0	0	0	0
flour	25	25	0	0	0	0	0
milk	22	22	0	0	0	0	0
oils	1	1	0	0	0	0	0
pork	38	38	0	0	0	0	0
potatoes	32	32	0	0	0	0	0

2. BHC (gamma)

beef	31	31	0	0	0	0	0
butter	1	1	0	0	0	0	0
chicken	4	4	0	0	0	0	0
flour	28	28	0	0	0	0	0
milk	40	40	0	0	0	0	0
oils	1	1	0	0	0	0	0
pork	38	35	2	1	0	0	0
potatoes	32	32	0	0	0	0	0

3. BHC (total)

beef	31	30	0	1	0	0	0
butter	16	14	2	0	0	0	0
chicken	4	4	0	0	0	0	0
flour	28	28	0	0	0	0	0
milk	40	39	1	0	0	0	0
oils	6	5	0	0	1	0	0
pork	38	35	2	1	0	0	0
potatoes	32	32	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000-	0.051-	0.101-	0.201-	0.301-	>
		0.050-	0.100	0.200	0.300	0.500	0.500

4. Chlorfenvinphos

potatoes	32	32	0	0	0	0	0
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5. Coumaphos

beef	31	31	0	0	0	0	0
milk	42	42	0	0	0	0	0

6. Diazinon

apples	1	1	0	0	0	0	0
cabbage	26	26	0	0	0	0	0
carrots	26	25	1	0	0	0	0
chicken	25	25	0	0	0	0	0
oranges	27	27	0	0	0	0	0
potatoes	32	32	0	0	0	0	0
tomatoes	41	41	0	0	0	0	0

7. Disulfoton

potatoes	32	32	0	0	0	0	0
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8. Parathion

flour	28	28	0	0	0	0	0
oranges	2	1	1	0	0	0	0
tomatoes	41	41	0	0	0	0	0

9. 2,4-D

flour	28	28	0	0	0	0	0
milk	43	43	0	0	0	0	0
potatoes	32	32	0	0	0	0	0

0.000-	0.501-	1.001-	1.501-	3.501-	>
0.500	1.000	1.500	3.500	5.000	5.000

1. Azinphos-methyl

apples	22	22	0	0	0	0	0
oranges	27	27	0	0	0	0	0
tomatoes	41	41	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000-	0.501-	1.001-	1.501-	3.501-	>
		0.500	1.000	1.500	3.500	5.000	5.000

2. Carbaryl

apples	22	22	0	0	0	0	0
beans (fresh or frozen)	24	24	0	0	0	0	0
cabbage	26	26	0	0	0	0	0
carrots	26	26	0	0	0	0	0
chicken	25	25	0	0	0	0	0
flour	28	28	0	0	0	0	0
potatoes	32	32	0	0	0	0	0

3. Chlorobenzilate

oranges	4	4	0	0	0	0	0
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4. DDT (total)

beans (fresh or frozen)	1	1	0	0	0	0	0
beef	31	31	0	0	0	0	0
butter	22	22	0	0	0	0	0
cabbage	2	2	0	0	0	0	0
carrots	13	12	1	0	0	0	0
chicken	19	19	0	0	0	0	0
chicken eggs	8	8	0	0	0	0	0
flour	28	28	0	0	0	0	0
milk	40	40	0	0	0	0	0
oils	5	5	0	0	0	0	0
oranges	1	1	0	0	0	0	0
pork	38	38	0	0	0	0	0
potatoes	32	32	0	0	0	0	0
tomatoes	40	40	0	0	0	0	0

5. Dicofol

apples	1	1	0	0	0	0	0
oranges	3	2	1	0	0	0	0

6. Endosulfan

apples	22	22	0	0	0	0	0
beans (fresh or frozen)	25	25	0	0	0	0	0
cabbage	26	26	0	0	0	0	0
carrots	26	26	0	0	0	0	0
milk	40	40	0	0	0	0	0
potatoes	32	32	0	0	0	0	0
tomatoes	40	40	0	0	0	0	0

Commodity	Number of Samples	Number of Samples Containing Residues Within the following Residue Ranges (ppm)					
		0.000- 0.500	0.501- 1.000	1.001- 1.500	1.501- 3.500	3.501- 5.000	> 5.000
7. <u>Phosmet</u>							
apples	4	4	0	0	0	0	0
8. <u>Lead</u>							
potatoes	32	32	0	0	0	0	0
9. <u>Malathion</u>							
flour	28	28	0	0	0	0	0
milk	42	42	0	0	0	0	0
oils	1	1	0	0	0	0	0
oranges	2	2	0	0	0	0	0
pork	39	39	0	0	0	0	0
tomatoes	41	41	0	0	0	0	0
10. <u>Maneb</u>							
potatoes	32	32	0	0	0	0	0
11. <u>Zineb</u>							
potatoes	32	32	0	0	0	0	0
tomatoes	41	41	0	0	0	0	0
		0.000- 1.000	1.001- 2.000	2.001- 3.000	3.001- 4.000	4.001- 10.000	> 10.000

1. Captan

apples	15	14	1	0	0	0	0
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2. Piperonyl Butoxide

flour	28	28	0	0	0	0	0
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The following numbers of samples of food were also examined for the presence of chlorinated hydrocarbon insecticides or organo-phosphorus insecticides by a non-specific group method. No residues were found in these samples:

Food Commodity	Number of Samples Examined For:	
	Chlorinated-Hydrocarbon Insecticides	Organo-Phosphorus Insecticides
butter	-	1
chicken	2	-
milk	1	-

Samples where residues were found were then analysed by a specific method and are listed in the tables under specific pesticides.

SUMMARY OF PESTICIDE RESIDUE RESULTS

<u>1.</u>	<u>Aldrin plus Dieldrin</u>		<u>Total No. of</u>	<u>% of Total</u>
	<u>No. of Food</u>	<u>Total No.</u>	<u>Samples above</u>	<u>Samples above</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>the First Level</u>	<u>the First Level</u>
'71 - '72	11	179	1	0.56
'72 - '73	12	420	11	2.62
'73 - '74	12	364	18	4.95
Total	12	963	30	3.12

<u>2.</u>	<u>Chlordane</u>		<u>Total No. of</u>	<u>% of Total</u>
	<u>No. of Food</u>	<u>Total No.</u>	<u>Samples above</u>	<u>Samples above</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>the First Level</u>	<u>the First Level</u>
'71 - '72	7	135	3	2.22
'72 - '73	7	255	0	0
'73 - '74	7	223	0	0
Total	7	613	3	0.49

<u>3.</u>	<u>Endrin</u>		<u>Total No. of</u>	<u>% of Total</u>
	<u>No. of Food</u>	<u>Total No.</u>	<u>Samples above</u>	<u>Samples above</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>the First Level</u>	<u>the First Level</u>
'71 - '72	1	17	0	0
'72 - '73	1	43	0	0
'73 - '74	4	46	0	0
Total	4	106	0	0

<u>4.</u>	<u>Fensulfothion</u>		<u>Total No. of</u>	<u>% of Total</u>
	<u>No. of Food</u>	<u>Total No.</u>	<u>Samples above</u>	<u>Samples above</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>the First Level</u>	<u>the First Level</u>
'71 - '72	3	77	0	0
'72 - '73	3	100	0	0
'73 - '74	3	84	0	0
Total	3	261	0	0

5.

Heptachlor plus Heptachlor Epoxide

	<u>No. of Food Items Sampled</u>	<u>Total No. of Samples</u>	<u>Total No. of Samples above the First Level</u>	<u>% of Total Samples above the First Level</u>
'71 - '72	10	141	0	0
'72 - '73	11	302	3	1.0
'73 - '74	10	260	4	1.5
Total	11	703	7	1.0

6.

Phorate

	<u>No. of Food Items Sampled</u>	<u>Total No. of Samples</u>	<u>Total No. of Samples above the First Level</u>	<u>% of Total Samples above the First Level</u>
'71 - '72	1	35	0	0
'72 - '73	1	43	0	0
'73 - '74	1	32	0	0
Total	1	110	0	0

7.

BHC(beta)

	<u>No. of Food Items Sampled</u>	<u>Total No. of Samples</u>	<u>Total No. of Samples above the First Level</u>	<u>% of Total Samples above the First Level</u>
'71 - '72	8	95	0	0
'72 - '73	8	173	0	0
'73 - '74	8	147	0	0
Total	10	415	0	0

8.

BHC(gamma)

	<u>No. of Food Items Sampled</u>	<u>Total No. of Samples</u>	<u>Total No. of Samples above the First Level</u>	<u>% of Total Samples above the First Level</u>
'71 - '72	8	108	1	0.93
'72 - '73	8	227	4	1.8
'73 - '74	8	175	3	1.7
Total	10	510	8	1.6

<u>9.</u>	<u>BHC (total)</u>			
	<u>No. of Food</u>	<u>Total No.</u>	<u>Total No. of</u>	<u>% of Total</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>Samples above</u>	<u>Samples above</u>
			<u>the First Level</u>	<u>the First Level</u>
'71 - '72	9	109	1	0.92
'72 - '73	10	242	7	2.9
'73 - '74	8	195	8	4.1
Total	12	546	16	3.1

<u>10.</u>	<u>Chlorofenvinphos</u>			
	<u>No. of Food</u>	<u>Total No.</u>	<u>Total No. of</u>	<u>% of Total</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>Samples above</u>	<u>Samples above</u>
			<u>the First Level</u>	<u>the First Level</u>
'71 - '72	1	35	0	0
'72 - '73	1	43	0	0
'73 - '74	1	32	0	0
Total	1	110	0	0

<u>11.</u>	<u>Coumaphos</u>			
	<u>No. of Food</u>	<u>Total No.</u>	<u>Total No. of</u>	<u>% of Total</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>Samples above</u>	<u>Samples above</u>
			<u>the First Level</u>	<u>the First Level</u>
'71 - '72	2	46	0	0
'72 - '73	2	101	0	0
'73 - '74	2	73	0	0
Total	2	220	0	0

<u>12.</u>	<u>2,4-D</u>			
	<u>No. of Food</u>	<u>Total No.</u>	<u>Total No. of</u>	<u>% of Total</u>
	<u>Items Sampled</u>	<u>of Samples</u>	<u>Samples above</u>	<u>Samples above</u>
			<u>the First Level</u>	<u>the First Level</u>
'71 - '72	3	74	0	0
'72 - '73	3	136	0	0
'73 - '74	3	103	0	0
Total	3	313	0	0

<u>13.</u>	<u>Diazinon</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	6	124	0	0
'72 - '73	6	194	1	.51
'73 - '74	7	178	1	.56
Total	7	496	2	.40
<u>14.</u>	<u>Disulfoton</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	1	35	0	0
'72 - '73	1	43	0	0
'73 - '74	1	32	0	0
Total	1	110	0	0
<u>15.</u>	<u>Parathion</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	2	27	0	0
'72 - '73	4	89	3	3.4
'73 - '74	3	71	2	2.8
Total	4	187	5	2.6
<u>16.</u>	<u>Azinphos-Methyl</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	3	39	0	0
'72 - '73	3	90	0	0
'73 - '74	3	90	0	0
Total	3	219	0	0

<u>17.</u>	<u>Carbaryl</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	7	116	0	0
'72 - '73	7	216	0	0
'73 - '74	7	183	0	0
Total	7	515	0	0
<u>18.</u>	<u>Chlorobenzilate</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72				
'72 - '73				
'73 - '74	1	4	0	0
Total	1	4	0	0
<u>19.</u>	<u>DDT (Total)</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	11	142	0	0
'72 - '73	14	339	3	.88
'73 - '74	14	280	1	.36
Total	15	761	4	.53
<u>20.</u>	<u>Dicofol</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	1	6	0	0
'72 - '73	2	6	0	0
'73 - '74	2	4	1	25
Total	2	16	1	6.2

<u>21.</u>	<u>Endosulfan</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	11	151	0	0
'72 - '73	7	250	0	0
'73 - '74	7	211	0	0
Total	11	612	0	0

<u>22.</u>	<u>Lead</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	1	35	0	0
'72 - '73	1	43	0	0
'73 - '74	1	32	0	0
Total	1	110	0	0

<u>23.</u>	<u>Malathion</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	4	64	0	0
'72 - '73	6	172	0	0
'73 - '74	6	153	0	0
Total	6	389	0	0

<u>24.</u>	<u>Maneb</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	1	35	0	0
'72 - '73	1	43	0	0
'73 - '74	1	32	0	0
Total	1	110	0	0

<u>25.</u>	<u>Phosmet</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	2	1	0	0
'72 - '73	1	7	0	0
'73 - '74	1	4	0	0
Total	2	12	0	0

<u>26.</u>	<u>Zineb</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	2	52	0	0
'72 - '73	2	86	0	0
'73 - '74	2	73	0	0
Total	2	211	0	0

<u>27.</u>	<u>Captan</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	-	-	-	-
'72 - '73	1	17	0	0
'73 - '74	1	15	1	6.7
Total	1	32	1	3.1

<u>28.</u>	<u>Piperonyl Butoxide</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	1	10	0	0
'72 - '73	1	37	0	0
'73 - '74	1	28	0	0
Total	1	75	0	0

29.	<u>Methoxychlor</u> <u>No. of Food</u> <u>Items Sampled</u>	<u>Total No.</u> <u>of Samples</u>	<u>Total No. of</u> <u>Samples above</u> <u>the First Level</u>	<u>% of Total</u> <u>Samples above</u> <u>the First Level</u>
'71 - '72	1	1	0	0
'72 - '73	-	-	-	-
'73 - '74	-	-	-	-
Total	1	1	0	0

APPENDIX VI

SNOW ACCUMULATION ON RURAL ROADS IN RELATION TO ROADSIDE VEGETATION

by TED LAIDLAW, Research Officer



Snow Accumulation on Rural Roads in
Relation to Roadside Vegetation

- Ted Laidlaw (Research Officer)

In the fall of 1974 the Authority became interested in the influence of roadside vegetation on snowdrift accumulation on rural roads and requested a staff investigation of the subject. The investigation was conducted by the writer of this appendix (which is based on a report he submitted to the Authority).

Part of the investigation involved field observations of snowdrifting. The area chosen for intensive study is located approximately 40 to 50 miles south and east of Edmonton, specifically the area around Beaverhill Lake between the towns of Tofield and Ryley in the south and Highway 16 in the north, in Beaver County No. 9.

This area was chosen for two reasons. The land in the vicinity of Beaverhill Lake is relatively level and from previous observations, it was realized that the influence of hills and road-cuts very much complicates the interaction between snow, wind and vegetation. Also, the area contains many examples of clumps and lines of native vegetation and of man-made shelterbelts of various kinds, with long stretches of open wind-blown terrain adjacent to them.

It should be noted that the winters of 1974/75 and 1975/76 (whatever their merits to stockmen and others who don't appreciate heavy snowfall and high wind speeds) were not particularly suitable to a field study of snowdrifting. Nevertheless, the writer did manage to observe some active drifting in the last week of March in 1975. Photographs were taken of various vegetation-snowdrift situations and are on file in the Authority's library.

The study also involved informal discussions with various federal, provincial and municipal employees working in the Edmonton area who were familiar with some aspect of snowdrifting. The opinions expressed by farmers and the municipal agricultural fieldmen during the pesticide hearings were also given careful attention, as these opinions were generally based on considerable first-hand experience.

A search for relevant literature was conducted and the writer gratefully acknowledges the assistance given by Mr. Herman Oosterhuis of the Alberta Department of Agriculture's shelterbelt program. Most of the reference material listed at the end of this Appendix was provided by him.

The writer also wishes to thank Mr. Jim MacKay, a District Agriculturist based in the town of Ryley, for the information he provided on the locations of various kinds of shelterbelts and snowdrifting situations in the Beaverhill Lake area.

In the course of the investigation, the writer became increasingly convinced that much of the reason for differences in opinion on the significance of roadside vegetation in causing snowdrift problems is due to a lack of clarity about the specific situation being discussed. Although the basic principles of snowdrifting are relatively simple, the interaction between wind, snow, topography and vegetation at a specific location may be quite complex. The following observations and generalizations should provide the reader with a basic understanding of the subject and an appreciation of the complexity of the interaction between the various factors affecting snowdrifting along a particular stretch of road.

Topographic Influence

Snow tends to be swept from the tops of exposed hills and level areas and to be deposited in the lee of hills and roadcuts and in gullies. Large amounts of snow may accumulate on a road which is bounded to the windward* by a hill or roadcut which is itself bare of dense, thick vegetation and which is also exposed to the windward for a considerable distance. Snowfencing is generally used in such situations to accumulate drifting snow on the hill crest before it reaches the adjacent road.

Direct Influence of Vegetation on Snowdrifting

According to the pamphlet Snow and Wind Control for Farmstead and Feedlot (page 9):

"When wind carrying snow encounters a solid obstacle in its path, the air flow is forced to separate. A zone of turbulence is created to the leeward of the object and due to reduced velocity, large

* "Windward" here means the direction from which high wind speeds normally come in winter. This direction is often not the same as that of the prevailing winter winds.

amounts of snow are deposited. Deepest drifts occur where wind velocity is least Just as windbreaks exhibit certain air flow characteristics, they also have peculiar snow drift patterns, depending on the density of the windbreak."

Also,

"over 90 per cent of drifting snow moves along within one foot of the ground."

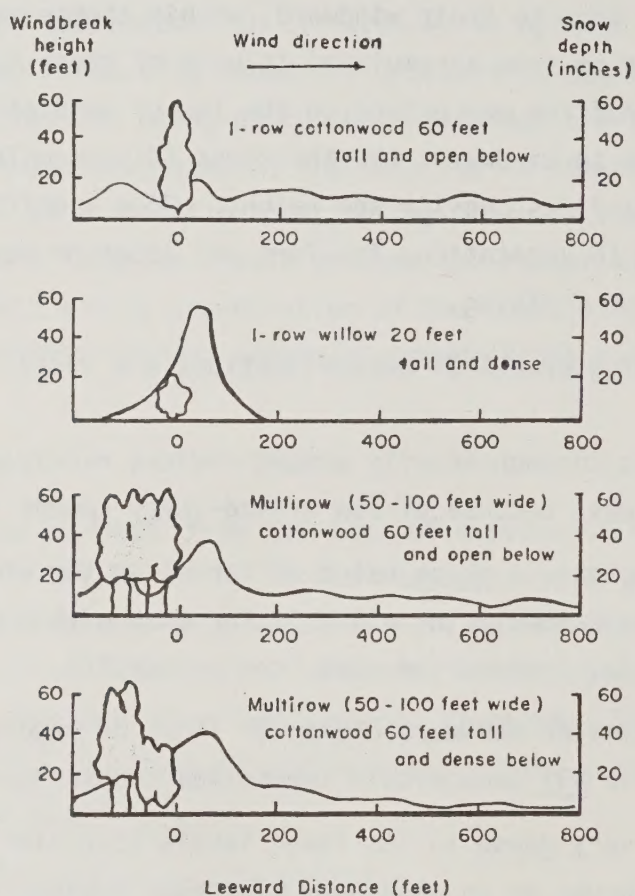
Clumps and lines of native vegetation and man-made shelterbelts may accumulate drifting snow to their windward, within themselves and to their lee. The relative amounts of snow accumulated in each of these three zones and the distance that snowdrifting may extend to the lee of vegetation is affected by the exposed distance to windward, the thickness (distance from side to side) of the vegetation, and its density and height. Once a drift has begun to develop in response to vegetation, its form and location may itself influence the nature of further drifting.

The following practical generalizations are valid in most circumstances:

1. Roads which pass through heavily wooded regions rarely are associated with snowdrift problems, because of low ground-level speeds in such areas.
2. In more open regions, a thick patch of forest on the windward side of the road may, by accumulating all drifting snow within itself, and on its windward side, protect the road from snowdrifts.
3. Considering native or man-made clumps or lines of vegetation of insufficient thickness to trap all snow within themselves and to their windward:
 - a) One that is very dense in its lower levels (contains a well-developed stratum of shrubs or an abundance of spruce boughs) will tend to develop relatively short, deep snowdrifts with the bulk of the snow piling up within the vegetation and in its immediate lee. The actual configuration of the drift will also of course be affected by the thickness and height of the vegetation. It should additionally be noted that the phrase "dense in its lower levels" means that this density should extend a few feet above any possible drift height for the duration of the winter.

- b) One that is porous in its lower levels but otherwise identical to a) in height and thickness would tend to develop a longer and thinner snowdrift which could extend a considerable distance to the lee of the vegetation, the actual distance being affected, again, by the vegetation's thickness and height.

Four common types of shelterbelt and their typical snowdrift patterns are presented in the following diagram*. Note that the heights of the snowdrifts relative to those of the shelterbelts have been greatly exaggerated:



Profiles of snow depth as influenced by windbreaks of different width and structure.

Vertical scales of tree height in feet and snow depth in inches are exaggerated.

* This diagram was copied from page 7 of the pamphlet Tree Windbreaks for the Central Great Plains (U.S.D.A. Handbook No. 250)

It follows from a consideration of a) and b) above that very dense shelterbelts (those containing a shrub such as caragana, or dense spruce) provided that they have sufficient thickness, could be safely located much closer to the windward side of a road than a shelterbelt which is more porous. In fact, very dense shelterbelts might be used to protect the road from drifting.

A shelterbelt planted for the specific purpose of protecting a road from drifting would preferably be thick enough and dense enough to trap most snow within itself and in its immediate lee. This would allow the shelterbelt to be planted quite close to the road, thus reducing the possibility of wind picking up snow from the lee of the shelterbelt and depositing it on the road (see earlier section on the influence of topography and the following section on road clearing operations).

Indirect Influence of Vegetation on Snowdrifting (Snow Clearing Operations)

Roads that are well-raised above the surrounding country and which are well-exposed to the wind tend to be swept clear of drifting snow, provided that snow accumulated directly from precipitation, when cleared, is immediately deposited in the ditches and not left on the shoulders.

Many rural roads are not raised, however, and those passing through level open country, with no fenceline vegetation or improperly-positioned shelterbelts present, may still develop a snowdrift problem. This is caused, ironically, by snow-clearing operations. The situation usually develops when a heavy snowfall is followed by grader clearing on more-or-less emergency basis, the aim being to get the greatest stretch of road open to traffic in the shortest possible time. Under such conditions the snow may be temporarily graded to the shoulders and not into the ditches. If high wind speeds should develop prior to the shoulder-clearing operation, the shoulder snow piles may accumulate drifting snow to their windward and lee, causing the choking of the road. This may in turn be followed by another "emergency" clearing operation, but the situation is now made worse by the ditches being partially filled with drifted snow. With the ditches eventually filled and new accumulations of snow, the situation may become quite serious. Snow removal experts are often adept at finding solutions to this problem by using high speed equipment which "throws" the snow a considerable distance from the road, by grading all fresh snow to the lee side of the road, etc. but such solutions may be expensive.

Although this problem can, as indicated above, develop in the total absence of vegetation, fencelines, shoulder and ditch vegetation may certainly make it worse. While ditch vegetation of the shrubby kind (willows, young poplars etc.) often does not contribute directly to snowdrifting it may contribute indirectly, by preventing graders from moving snow from the shoulders and into the ditches.

Conclusions and Recommendations

1. The general policy that new windbreaks (shelterbelts) be located at least 125 feet back from the edge of the road appears well-founded and is not disagreed with here. There may, however, be special circumstances in which a windbreak somewhat closer to the road might be desirable. The purpose of the windbreak, the extent of open country to its windward, its height, thickness and density are some factors which could determine the proper distance of a specific windbreak from the road. It is recognized that the proximity of trees (particularly coniferous trees) to a road can affect the condition of the road surface in other ways than through causing or preventing snow accumulation. Wetness, icing and frost-heaving in spring may all be worsened by trees being too close to a road. Visibility may also be seriously impaired (the danger of large wildlife unexpectedly moving on to the road may be a serious one in cases in which high-speed traffic is the rule).

On the other hand, thick, dense woody vegetation abutting the windward side of a road may prevent snowdrifting and might in some cases be desirable from an aesthetic point of view as well.

2. In situations in which high winter wind speeds almost invariably come from one section of the compass, fenceline vegetation on the perpetual lee side of the road may contribute very little to snowdrifting and should be removed (or moved back) only if it is known to be causing a problem. In general, thin lines of well-spaced deciduous trees or low shrubs such as wild rose often do not contribute significantly to snowdrifting when they are located on the lee side of the road, even if at fencelines. Provided it is sufficiently porous and thin or is buried by snow early in the winter, woody vegetation located at fenceline on the windward side of the road also may not contribute to snowdrifting.

3. Ditch vegetation which is definitely interfering (or will interfere if allowed to develop) with grader operations must obviously be removed by one means or another. Problem vegetation would certainly include young poplars and clumps of willow, which commonly establish in ditches shortly after the ditch has been created and before herbaceous perennials have come well-established. Whether or not low, supple shrubs such as wild rose or tall tough herbs such as sweet clover (a valuable bee pasture in some areas) would in general cause enough of a problem to justify removal is debatable, however. Again, the specific situation should be examined on its own merits, on the basis of site-specific grader experience and a weighing of the local pros and cons of removing the plants or allowing them to remain.
4. The overall conclusion reached by the writer on the basis of this investigation and also on the basis of some personal familiarity with snowdrifting (it may prevent one from reaching the office, a situation which may be good or bad, depending on one's point of view) is that it is dangerous to generalize too much about the relationship between snowdrifting and roadside vegetation. It therefore seems to follow that removal of existing roadside vegetation of various kinds, and its replacement with grass, should be done with some sensitivity, in response to local conditions and experience. This would especially be the case where the existing roadside vegetation is weed-free and has some recognizable value in terms of aesthetics, desirable bird habitat, bee pasture, etc. Blanket spraying of the road allowances of entire counties and the removal of woody fenceline vegetation may in some cases be justifiable but it often is not, at least not in terms of snowdrift problem-solving.
5. Snowfencing is often erected on the crests of exposed hills that are to the windward of the road. In certain situations (e.g. when the land involved is under permanent pasture and where woody vegetation is scarce - a combination common in southern and eastern Alberta) it might be possible and beneficial to replace snowfencing with very dense woody vegetation.

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